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UNIVERSITY OF ALBERTA

CHILDREN'S CONSTRUCTION OF MEANING

IN AN ENVIRONMENTAL PROGRAM

BY

© STELLA STIRLING

A thesis

submitted to the Faculty of Graduate Studies and Research

in partial fulfillment of the requirements for the degree of

MASTER OF EDUCATION

DEPARTMENT OF ELEMENTARY EDUCATION

Edmonton, Alberta

SPRING, 1993

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **CHILDREN'S CONSTRUCTION OF MEANING IN AN ENVIRONMENTAL PROGRAM** submitted by **STELLA M. STIRLING** in partial fulfillment of the requirements for the degree of **MASTER OF EDUCATION**.

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ABSTRACT

The current environmental crisis has stimulated an examination of the role of education in the development of an environmentally responsible public. This qualitative study explores the environmental meanings constructed by ten grade five students during their participation in a three-day environmental education program. The children experienced a variety of environmental, historical and outdoor sports activities in a three-day winter residency program at a school-board operated Environmental Education (EE) Centre. The program was planned by the children's teachers, and carried out with the assistance of staff at the EE Centre.

The children's construction of environmental meaning was explored through individual interviews and observations made both in the classroom and at the EE Centre. These data are presented in two ways: as descriptive portraits of each child's meaning-making and, as well, through comparisons of the students' responses to the different activities.

A variety of factors, significant from a constructivist view of learning, seemed to influence each individual's construction of environmental meaning. These included the child's prior ideas, knowledge and attitudes about environment, his or her exposure to relevant classroom studies, the experiential and role-playing nature of the activities, the extended opportunities for social interaction, and the group discussions which followed each activity.

Predominant themes of survival, cooperation and competition emerged from the students' construction of meaning for their experiences in the program.

Discussion of such themes after participation in activities helped students understand the analogy between their cooperative efforts in game situations and the potential for using similar group problem-solving strategies to find environmental solutions.

The activities experienced by the children in this environmental program were not of an inquiry nature, and did not entail study of the actual outdoor environment. However, each child's awareness of environmental issues, concepts and action strategies appeared to increase through participation in the simulation and role-playing games, environmentally responsible actions and discussions about environmental issues. Motivation to act for the environment seemed to remain consistent with the child's stance toward environment as revealed prior to the residency program. All the children expressed concern and apprehension about the future of the environment.

This study suggests that students' environmental meaning-making and awareness can be promoted through constructivist approaches. These include group problem-solving experiences, an integrated approach, experiential activities and opportunities for students to reflect on and share meaning for environmental experiences and issues.

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TABLE OF CONTENTS

CHAPTER		PAGE
I.	**INTRODUCTION**	1
	Purposes for the Study	3
	"Meaning"	4
	Significance of the Study	5
II.	**LITERATURE REVIEW**	6
	Introduction	6
	Environmental Education	6
	Curricular Emphases in Environmental Education	6
	Current Objectives for Environmental Education	8
	Promoting Responsible Environmental Behaviour	9
	Construction of Meaning	12
	Constructivist Theory and Concept Development in Science	14
	Prior Knowledge and the Construction of Meaning	14
	Conceptual Change	16
	Social Influences on Learning in Science	17
	Using Metaphors and Analogies to Teach Science and Environmental Concepts	19
	Environmental Education and Social Responsibility	20

III. METHODOLOGY AND DESIGN OF THE RESEARCH 22

Introduction 22

The Qualitative Methodology 22

Data Collection 24

Field Notes 24

Audio-Taped Interviews 25

Other Data 27

Analysis and Presentation of the Data 27

Beginning the Research 28

Approaching the Environmental Education Centre 28

Finding a Teacher and a Class 29

The School 29

The Teacher 30

The Children in the Study 30

Selection of Profile Children 31

Limitations of the Study 31

IV. CONTEXTS OF THE STUDY 34

Introduction 34

The Context of the EE Centre 34

Programs at the EE Centre 34

Teachers' Use of the EE Centre Residency Programs 35

Residency-Planning Workshop 36

Environmental Education at the EE Centre 37

Student Learning at the EE Centre 39

The Context of the Teacher and Her Program 40

The Classroom Context 40

Anticipating the Field Trip 41

The Teacher's Use of the EE Centre 41

Teachers' Planning for the Residency Program 43

Why Are We Going to the EE Centre? 43

EE Centre Journals 45

What Does Being Responsible to the Environment Mean? 46

Behaviour Expectations 47

Where is the Environmental Education Centre? 48

The Curricular Context 49

Social Studies 49

Science and Environmental Studies 50

After the Field Trip 52

The Teacher's Follow-up to the Field Trip 52

The Teacher's Evaluation of the Field Trip 53

Summary 53

V. **PORTRAITS OF THE CHILDREN'S CONSTRUCTION OF MEANING IN THE ENVIRONMENTAL PROGRAM** 55

Introduction 55

The Portraits 56

Daymon 56

Melanie 59

Janet 62

Becky 65

John 69

Monique 72

Mark 77

Jason 81

Jesse 82

James 83

Discussion 85

VI. **CHILDREN'S CONSTRUCTION OF MEANING IN THE ENVIRONMENTAL GAMES AND ACTIVITIES** 89

Introduction 89

The Environmental Bingo Game 90

The Debriefing 91

Themes 91

Commentary 95

The David Thompson Climb 96

Introduction to the Historical Context 97

The David Thompson Climb 97

The Debriefing 98

Themes 99

Competition Themes 99

Cooperation Themes 100

Effective leadership 100

Talking, sharing ideas, and giving encouragement 101

Cooperating with the decisions of the majority 101

Survival Themes 102

Physical survival of the explorers 102

Survival of the natural environment 104

Commentary 105

The Animal Survival Game 107

The Debriefing 108

Survival Themes 109

Survival as a Game Player 109

Survival Adaptations of Animals 110

Survival of the Sasquatch Myth 112

Commentary 115

The "L'Hivernant" Game and Related Activities 116

Themes 117

Competition Themes 118

Competition in the Game 118

Reasons for the Fur Trade Competition 119

Economic Competition 121

Influence of the Fur Trade on Natives 122

Survival Themes 125

Survival of the "Hivernants" 125

Survival of the Natives 126

Survival of Animals: 127

Commentary 129

VII. DISCUSSION 131

Introduction 131

Emerging Themes: Survival, Competition and Cooperation 132

Influences on Children's Construction of Meaning

About the Environment 135

Prior Knowledge 135

The Social Context 136

Post-Activity Debriefing 137

Experiential Learning 138

Personal Stance Toward Acting for the Environment 138

Implications for Environmental Education 140

Using Students' Ideas 140

Promoting the Social Negotiation of Meaning 140

Validating Children's Stances Towards Environmental Issues 142

Using the Outdoors 142

Approaches to Environmental Education 144

Future Studies 147

VIII. REFERENCES 149

IX. APPENDICES

Appendix A: Parent Permission Letter 156

Appendix B: Reference to Research Project in Parent Newsletter 158

Appendix C: EE Centre Three-Day Residency Program: Schedule of Activities and Times 159

Appendix D: Cross-Country Skiing 162

Appendix E: How Many Bears Live in the Forest? 165

Appendix F: Win As Much As You Can 176

Appendix G: The Initiative Tasks 181

CHAPTER I

INTRODUCTION

Current environmental problems are both serious and widespread. This has refocused interest in developing education programs in the schools to educate a citizenry to be both informed decision-makers on environmental issues, and to act in more environmentally considerate ways. Many schools and school districts are responding by prioritizing environmental awareness programs and activities, and by teaching environmental concepts across the curriculum. What do these environmental awareness activities mean to the students? What are children thinking about the environment?

Two years ago, when numerous schools in my district were starting paper recycling programs, I carried out a small action research project with the students in my year five classroom. I wanted to see if voluntary participation in establishing and maintaining a school recycling program would have any effects on their actions, understanding or attitudes towards environmental issues. I encouraged the students to plan and carry out the work themselves and to reflect on what it meant to be involved in such a project. I found that their awareness of environmental issues, and their willingness to take positive environmental action in other realms of their lives appeared to increase after participating in the recycling project they had organized themselves. Their reasons for being involved included the satisfaction of taking action "to help the environment," a cause they deemed

important, and the social satisfaction of working with peers. Taking ownership for the action plan was also an important source of satisfaction.

I began to wonder which of the various activities in schools which relate in some way to the environment, such as science and social studies lessons, outdoor field trips, current events discussions, or cooperation with school-wide recycling programs, actually influence students' understanding of environmental concepts, their awareness of environmental issues and values or their motivation to help solve environmental problems. There seemed to be a number of environmental education objectives here. Perhaps it is not individual experiences but their sum effect which motivates students to take action. I thought it would be interesting to explore the contribution of one of these environmental education experiences to children's construction of meaning about environment.

I thus thought of the environmental programs offered at the popular Environmental Education Centre (EE Centre) operated by my urban school board in a western Canadian city. Programs offered there have been created to support various provincial curricula and to make use of the EE Centre's unique location in a river valley in the centre of the city close to parks, bike trails and the river. What does a three-day residential visit to the EE Centre mean to students?

When I stayed at the EE Centre with classes in the past I was impressed by how much we enjoyed the outdoor learning experiences and staying overnight together. Students spoke enthusiastically about the outdoor games, sports and

activities, many of which focused on environmental themes. I wondered what meanings the students constructed from these experiences and in what ways these meanings contributed to the students' understanding of environment and their sense of responsibility toward it.

Purposes for the Study

There were three purposes for this study. First, I hoped to discover and explore the meanings which individual children constructed about their experiences in a three-day residential program at an environmental education centre. Secondly, I hoped to gain insight into the contribution of various influences on the children's construction of meaning. I thus examined the nature of the children's prior ideas, the teacher's context for the field trip, and the context for learning at the environmental centre, including the outdoor setting and activities, and the immersion social situation. The third purpose for the study was to explore implications of the children's meaning-making for the development of environmental education programs in schools.

Because children's construction of meaning is influenced by the contexts within which it occurs (Bruner, 1986; Driver & Oldham, 1986), the study took place both in the classroom and at the EE Centre over a period of six weeks around the three-day field trip. Through field notes, audio-taped interviews, student work, and on-going conversations with the classroom teacher, I explored in depth

the views of ten grade five children.

"Meaning"

The phrase "construction of meaning" reflects the constructivist view of learning that I have used as an interpretive stance in this study. Driver (1989) describes construction of meaning as active "sense-making" (p. 482). It is "an adaptive process . . . in which the learner's conceptual schemes are progressively reconstructed so that they are in keeping with a continually wide range of experiences" (p. 482). She also acknowledges the influence of social processes on construction of meaning. These include the mediating effect of language and the influence of the "ways of seeing" (p. 482) of the established culture. Bruner and Haste (1987) also emphasize the social aspects of meaning construction or "making sense" (p. 1). They assert that children, through their social interaction with others, construct "a framework for interpreting experience" and learn how to "negotiate meaning in a manner congruent with the requirements of the culture" (1987, p. 1).

"Meaning" in this study then, refers not only to the cognitive or conceptual understandings of the children, but also to the social significance or value they held for situations. When describing their responses to the events of the environmental education program, the profile children usually first expressed meanings for the social or affective importance of the events. Further discussion revealed extensive conceptual understandings. It seemed important to acknowledge such social and

affective meanings since they indicate the status or relevance of some of the learning events to the children. Pope and Gilbert (1983) suggest that the personal relevance of learning events influences conceptual learning. As well, Iozzi (1989a) stresses the importance of the affective domain in environmental education:

> It seems that researchers in environmental education recognized quite early that focusing on the affective domain was extremely important if programs in environmental education were to be effective in teaching positive environmental attitudes and values. Whereas knowing how to improve environmental quality is important, possessing such knowledge certainly does not ensure that one will be motivated to take action. (p. 4)

Significance of the Study

In this study I have explored the meanings individual children constructed in some specific outdoor and environmental education activities. The study reflects both the uniqueness and commonalities of the children's construction of meaning and, I hope, enhances our understanding of various influences on children's thinking about environment and their motivation to take action for the environment. Implications for school curricula and environmental education (EE) programs to educate a more environmentally aware and responsible citizenry are discussed.

Readers may identify with various aspects of the study and its interpretation. The insight into children's thinking about environment may enrich readers' understanding of their own EE inquiries. They may find that the description of the teaching methods and the discussion of factors influencing children's environmental learning help them reflect on their use of environmental field trips and programs

CHAPTER II

LITERATURE REVIEW

Introduction

In this chapter I review literature relevant to an exploration of children's construction of meaning in an environmental program. Research in the areas of environmental education, constructivist theory, and concept development in science are used to illustrate the context and impetus for the study.

Environmental Education

Curricular Emphases in Environmental Education

Environmental education can take various configurations within the elementary curriculum, depending on the purposes for its inclusion in the curriculum. Neal and Palmer (1990) describe three different views or curricular emphases of environmental education programs:

1. Environmental education as a medium for learning: skills emphasis. The environment is used as a medium for learning inquiry and communication skills. Concrete experiences enhance learning in science, language and mathematics. This is referred to as education "through" or "in" the environment.
2. Environmental education as a subject: subject emphasis. Here, the learning of

fundamental concepts about the environment and their interconnection is stressed. The means of achieving this may vary. This is called education "about" the environment.

3. Environmental education for promoting responsible behaviour toward the environment: action emphasis. As well as knowledge about the environment, skills and strategies for taking action on environmental issues are taught. The purpose is to promote environmentally responsible behaviour. This is called education "for" the environment.

Robottom (1987) suggests that these three emphases or definitions promote environmental education as a "slogan system" (p. 17). By this he means that EE activities can be said to be taking place but do not actually educate "for" the environment. Robottom comments, "The generic nature of the term 'environmental education' leaves open the question of what will actually happen under the slogan (in, about, or for) and thus permits, if not encourages change that is symbolic only" (p. 17).

Robottom (1987) argues that the failure of EE to meet its goals is due to the present technocratic administration and philosophy in schools which preserves forms of non-critical education about the environment. Education for the environment is socially critical in nature, and challenges the established social order.

Current Objectives for Environmental Education

Increasing concern about global environmental problems has fostered research into ways to develop more effective environmental education to promote responsible citizenship behaviour. Hungerford and Volk (1990) comment on the impetus for such research: "We can point to relatively few successes that offset the severity of environmental degradation and the serious problems associated with human reproductivity" (p. 15). They comment further: "When current reports on environmental quality are considered, we must admit that we have not been successful, on a widespread basis, in convincing world citizens to act in environmentally responsible ways" (p. 16).

Hungerford and Volk (1990) cite five objectives for environmental education identified by the UNESCO-sponsored Intergovernmental Conference on Environmental Education held in Tbilisi, USSR, in 1977. These objectives are to develop:

1. awareness of environmental issues,
2. sensitivity to the environment,
3. attitudes and values to motivate participation in environmental improvement,
4. skills for solving problems, and
5. opportunities to be active in solving environmental problems.

Translating these Tbilisi objectives into reality remains a major challenge to

educators worldwide. In the traditional model of environmental education it was thought that increasing people's knowledge about the environment would increase their awareness of environmental problems and this in turn would motivate them to act in more environmentally responsible ways. Hungerford and Volk (1990) report that this linear model has not been very effective in changing behaviour.

Gigliotti (1990) acknowledges that the environmental movement has had some success in increasing public awareness, and has pressured people to recycle. He believes though, that environmental education (EE) must address the teaching of in-depth ecological concepts. He comments, "We seem to have produced a citizenry that is emotionally charged but woefully lacking in basic ecological knowledge " (p. 9). EE must also teach people that they are not separate from the environment, and that "the environment places the same limitations on people as it does on other living things. From this must flow the realization that each individual is responsible for the current levels of pollution and resource depletion" (p. 10). Gigliotti emphasizes that the development of personal responsibility toward the environment is a major goal of EE.

Promoting Responsible Environmental Behaviour

What does being responsible to the environment mean? Hungerford and Volk (1990) identify behavior variables associated with responsible environmental behaviour. These variables can be clustered in three groups, each showing increased commitment to action:

1. Entry-level environmental behaviour variables, which include environmental sensitivity, knowledge of ecology and attitudes toward pollution,
2. Ownership environmental behaviour variables, which include behaviours that make environmental issues very personal, such as having in-depth knowledge of environmental issues and a personal investment or stake in resolving problems, and
3. Empowerment environmental behaviour variables, which include knowledge of different environmental action strategies, perceived skills in using these strategies, and the intention to act. These factors are critical in learners for environmental education training to lead to responsible action.

Hungerford and Volk note that these complex behaviour variables make effective planning in environmental education difficult. Their review of the current research in EE (1990) reveals that there are, however, some EE strategies which seem to successfully promote environmentally responsible behaviour. These include:

1. teaching significant ecological concepts and environmental interrelationships,
2. providing opportunities to achieve environmental sensitivity and appreciation,
3. teaching in-depth knowledge of issues,
4. teaching skills of issue analysis and investigation,

5. teaching citizenship skills needed for issue remediation, and providing time for this, and
6. increasing learners' expectancy of reinforcement for taking responsible action.

These "critical education components" (Hungerford & Volk, 1990, p. 14) for changing learner behaviour toward the environment can be used to gain understanding of the programs at the environmental centre in this study.

Hungerford and Volk (1990) further suggest that an effective EE instructional model for elementary students is the extended case study, where students in small groups pursue study of a single environmental issue in depth. Students achieve a strong sense of issue ownership which may be a precursor to action behaviour.

Keeth (1989) explores the experiences of people trying to teach, take or promote environmental action. The teachers in her study all acknowledged the necessity of outdoor field trips for environmental education but found that restrictions of time, curricula and the structure of schools all posed roadblocks.

An important objective of environmental education is the development of attitudes favourable to action (Gigliotti, 1990; Hungerford & Volk, 1990; Iozzi, 1989). Attitudes stem from the values people hold. It is important to help students identify their own and others' often conflicting values towards the environment. Gigliotti (1990) comments:

> Our citizenry does not completely lack information. Instead, it is attitudes, which are based on a number of interrelated beliefs and values, that are the problem. These beliefs are often either not ecologically sound or are not based on comprehensive knowledge, such as information on the alternatives and consequences of actions, and information on possible individual action. (p. 10)

Hendry (1983) explores some of the diverse environmental value positions held through history. Some of these value stances conflict; for example, the ecocentric versus the technocentric value position on the environment, and the preservationist versus the conservationist. Through appropriate activities elementary children can come to understand that people hold different values about hunting, pulp mills, factories, pesticides and so on. Hendry (1983) recommends that "the schools provide, particularly through their environmental education programs, a means for developing an awareness and understanding of environmental values - past, present and future - in the policy-makers of the future" (p. 37).

Construction of Meaning

How do children come to make meaning out of learning events and experiences such as a field trip to an environmental education centre? What is the nature of this meaning? Bruner (1986) proposes that several factors are involved in meaning-making, based on the constructivist view that "what exists is a product of what is thought" (p. 96). We construct and reconstruct our own meanings for events, creating our own "possible worlds" and our own "alternative possible

perspectives on those worlds" (p. 54). Bruner (1986, p.96) borrows this idea from Nelson Goodman (1978), who says we invent our own realities or "worlds" then use these invented constructions as premises on which to construct further worlds.

Another important aspect of meaning-making, Bruner (1986) asserts, is that our expectations of events influence our understanding of them. "Perception is to some unspecifiable degree an instrument of the world as we have structured it by our expectancies" (p. 47). We see and understand what we expect.

Bruner (1986) also stresses the importance of language in meaning-making. He says, "Language . . . serves the double function of being both a mode of communication and a medium for representing the world about which it is communicating. How one talks comes eventually to be how one represents what one talks about" (p. 131). Because of its symbolic nature, written and spoken language not only communicate meaning but can also create it. Over time we create a sense of self-identity from the meanings we negotiate through language. Bruner continues:

> Language not only transmits, it creates or constitutes knowledge or "reality". Part of that reality is the stance that the language implies toward knowledge and reflection, and the generalized set of stances one negotiates creates in time a sense of one's self. (p. 132)

Bruner (1986) states further that construction of personal meaning is influenced by transactions with others in a social/cultural setting:

> When we are puzzled about what we encounter we renegotiate its meaning in a manner that is concordant with what those around us believe. . . So if one asks the question, where is the meaning of

> social concepts - in the world, in the meaner's head or in interpersonal negotiation - one is compelled to answer that it is the last of these. Meaning is what we can agree upon or at least accept as a working basis for seeking agreement about the concept at hand. (p. 122)

In this study, students arrived at the EE Centre, each with individual expectations and individual background knowledge; and there, in a setting ideal for intensive language transactions and socially-negotiated meanings, they created their own meanings or possible worlds from all that happened.

Constructivist Theory and Concept Development in Science

Prior Knowledge and the Construction of Meaning

Current research in the learning and teaching of science has also drawn on constructivist theory in holding that the learner actively constructs personal knowledge (Driver, 1989). Prior experiences influence the learner's sensory perceptions of events, and hence "knowledge" is personally constructed, and tentative in nature (Driver, 1989).

The generative learning model proposed by Osborne and Wittrock (1985) incorporates aspects of both Bruner's constructivist theory and the information-processing tradition of cognitive psychology. The generative learning model emphasizes that the learner's prior experiences, as stored in memory, influence his/her sensory perception of events. "Input" is thus selected which agrees with the prior learning. This concurs with Bruner's notion of expectancy (1986, p. 47).

Both selective sensory input and the individual's prior ideas influence the generation of new ideas or learning. Some of the implications of this model for learning in science include recognition of the importance of sensory-rich experiences in the teaching of concepts, and the importance of considering the prior knowledge that the learner brings to science lessons. This research suggests that the concrete, hands-on experiences emphasized in programs at the EE Centre would likely be significant in the students' meaning-making. Also, their learning would be influenced by prior knowledge and ideas about environment.

Research into the influence of students' prior ideas on their learning in science (Driver, 1981, 1989) reveals that students hold a wide range of ideas about phenomena in different domains of science. Some of these ideas are not those held by the scientific community. Such misconceptions or "alternative frameworks" are often resistant to change despite classroom teaching (Freyberg & Osborne, 1985; Harlen & Osborne, 1985; Hodson, 1988). This research has relevance for interpreting findings in this study. Of interest is that students' conceptions of current environmental issues have not been widely explored. Recognition that students hold strongly to their alternative framework conceptions led to research into ways to promote conceptual change to help students construct science concepts more in accord with those of the current scientific community.

Sutton (1992) explains the special nuance of the term "construction":

> Researchers into children's learning in science have used the word 'construction' mainly about the internal processes in one person's

> mind: the sense making, interpretation or meaning-finding which is done by the active imagination of an individual thinker. (p. 107)

He points out that it is important to distinguish between such individual insights and "'public knowledge' . . . the product of collective activity by a community of scientists" (p. 105). Public knowledge in science is "the temporary structure of critically appraised theories" (p. 106), or the agreed way of understanding a topic. It develops by using the insights of many contributing individuals but is not identical with any single insight. This division between personal and public science presents a dilemma in education. On the one hand students construct their own meaning within the framework of public knowledge. On the other hand, teachers strive to help students understand and make use of the public knowledge in science. Sutton adds, "For the practice of science one is not much concerned with people's individual mental versions of an idea, but more with what they have in common" (p. 106).

Conceptual Change

If students do hold science beliefs that are incompatible with those of scientists, by what process do they relinquish them in favour of the accepted scientific views? Posner, Strike, Hewson & Gertzog (1982) propose a theory of conceptual change based on philosophy of science. It parallels the process described by Thomas Kuhn (1970) in The Structure of Scientific Revolutions, by which radical new theories in science come to replace older theories. As with the scientists, the students appear to reject one theory in favour of another only if the

first theory fails to satisfactorily explain certain phenomena, and if the competing theory is intelligible, plausible and fruitful (Posner et al, 1982).

Pope and Gilbert (1983) find that learning in science is more likely to occur if the student finds the topic and its associated concepts personally relevant. They stress that teachers need to become aware of their students' current perspectives. Encouraging students to talk about and reflect on their own views helps them to "recognize their role as theory builders" (p. 193).

Baird, Fensham, Gunstone and White (1991) suggest that the person's knowledge and self awareness about the nature of their own learning and thinking, metacognition, can assist in effecting conceptual change in science because it "empowers the learner to undertake the constructivist processes of recognition, evaluation, and revision of personal views" (p. 164). Metacognition, they say, helps the learner control the nature and direction of conceptual change. Metacognitive activities such as discussing personal interpretations of concepts and writing reflective journals foster both cognitive and affective development, and help to promote conceptual change.

Social Influences on Learning in Science

Environmental issues are often the subject of both casual and formal discussion in science lessons. Solomon (1990) maintains that discussion of social issues in the science classroom plays an important role in helping students to negotiate their personal meaning and values within these issues. Talking in small

groups assists both science learning and issues clarification. Moreover she asserts (1987), social consensus has a strong influence on students' interpretation of science experiences, and often takes the place of logical testing:

> The agreement of others is so important to the working-out of personal belief that group pressures may best be seen, not as a pruning and adjustment of existing ideas, but as an integral part of the process of coming to believe in them. Group consensus or argument becomes a cognitive process of construction rather than a smothering of differences. (p. 117)

Solomon says students' beliefs about environmental issues are also influenced by the predominant ways of thinking or social consensus as, for example, promoted by the media.

Solomon (1990) finds that children and adults alike attribute much of their science knowledge to television. She indicates that more research is needed to learn how television affects people's understanding of and attitudes towards science and environmental issues. Her research shows that many high school students excuse their lack of scientific understanding and feel powerless to influence issues in science, technology and society (Solomon, 1990). Elementary-aged students hold naive understandings of current environmental problems but do express anxiety about them. Solomon suggests that classroom discussion and talking are important in helping to alleviate young students' concerns about environmental crises (personal communication, Oct. 23, 1991).

Using Metaphors and Analogies to Teach Science and Environmental Concepts

Several of the environmental activities the children experienced in this study involved the use of metaphor or analogy to help teach science concepts or to suggest environmental solutions. Duit (1991) defines the term "analogy" as "comparisons of structures between two domains" (p. 649). Duit comments on how analogies are used in the learning process. In the constructivist view, he says, "learning is often not simply a continuous chain of enlargements but a totally new construction of the already known" (p. 652). These reconstructions of knowledge or conceptual changes are similar to what Kuhn (1970) describes as "paradigm shifts" that take place in scientists' thinking through history. "Learning, therefore, fundamentally has to do with constructing similarities between the new and the already known. It is precisely this aspect that emphasizes the significance of analogies in a constructivistic approach" (p. 652). Duit continues, "Analogies are of pivotal importance in conceptual change learning since they may help to restructure existing memory and to prepare it for new information" (p. 653).

Metaphors also make comparisons, but implicit ones. Duit (1991) explains:

> It appears to be the very essence of a metaphor that the grounds of the comparison are hidden. Metaphors always have some aspect of surprise; they provoke anomaly. In this sense metaphors are comparisons where the basis of comparison must be revealed or even created by the addressee of the metaphor. (p. 650)

Metaphors help people to view the familiar in totally new ways, with deeper

understanding. By linking feeling with thinking they bridge the gap between the cognitive and the affective.

Sutton (1992) points out that metaphor in science exploits the interpretive system of language, allowing an unlimited number of implications to be explored. "A metaphor brings into tension two previously disparate ideas and invites you to see one in terms of the other. . . . In the live metaphor the thoughts co-exist and continue to provoke insight" (p. 20).

Pope and Gilbert (1983) propose that using metaphors or analogies to teach science concepts can be especially helpful "where it is impossible to organize direct physical experience with exemplars of the concepts" (p. 200). Metaphors or analogies "link with the experiential world of the student" and engender cognitive processing "through which a student may give meaning to scientific concepts" (p. 200). It is as if the power of metaphor and analogy is to access intuitive knowledge.

Environmental Education and Social Responsibility

In this chapter I have presented some of the current research issues in environmental education and constructivism. This research will be used as a framework to illuminate and interpret the construction of environmental meaning by the children in the study, and to examine the contribution of their experiences in the three-day environmental education program to this process.

The major thrust of environmental education must be to develop a citizenry that feels both responsible and willing to act for the environment. Gigliotti (1990) emphasizes the need to promote responsibility:

> Environmental education needs to break down the environmental myths of today and start showing the individual connections to today's environmental problems. At the same time education should help individuals learn what they can and should do to improve the environment and create a desire in each person to take the correct actions, including those that require individual sacrifice. (p. 12)

The implication is that evaluation of environmental programs must examine the students' attitudes, intentions or actions toward the environment as well as their understanding of the processes of environment. The literature shows that meaning is not constructed in social isolation, so such valuing and social elements are also reflected in my exploration of the children's construction of meaning.

CHAPTER III

METHODOLOGY AND DESIGN OF THE STUDY

Introduction

A search for meaning calls for a qualitative, interpretive methodology. In this chapter I discuss the qualitative methodology used, and describe the design of the study and how this took shape as the research began.

The Qualitative Methodology

"Qualitative research," states Eisner (1991), "is concerned with matters of meaning . . . . the meaning events have for those who experience them" (p. 35). In this study I explored individual children's construction of meaning in an environmental program through *description*, *interpretation*, *evaluation*, and *drawing themes*. Eisner (1991) describes these as the four dimensions of qualitative research. *Description* allows the reader to see and feel vicariously the situation depicted in order to gain his/her own insights. The goal of good description is to promote understanding of the essential features under discussion. *Interpretation* is an attempt to express the meaning of what is described. It means "illuminating the potential consequences of practices observed and providing reasons that account for what has been seen" (Eisner, 1991, p. 95). Qualitative research performs an *evaluative* function through appraising or valuing what is occurring, in the context

within which it occurs. *Themes* are the dominant features or recurring messages in the situation described. Through drawing themes, a researcher identifies elements that reach beyond the particular situation, linking it to other, similar situations, thus making comment on them as well. Through themes, the experience in one situation is generalized to others (Eisner, 1991). These four dimensions are not independent of each other, but are often explored simultaneously. They provide a possible structure for a qualitative approach to educational criticism (Eisner, 1991).

In attempting to represent the meanings or realities of others in this study, I am not trying to depict an objective reality or truth, but rather, attempting to present an account that is credible to both participants and readers.

Eisner (1991) proposes that to meet "reasonable standards of credibility" qualitative research requires three sources of evidence: *structural corroboration*, *consensual validation*, and *referential adequacy* (p. 110).

Structural corroboration means using multiple types of data to look for recurrent behaviours or theme-like features that characterize a situation. Such a "confluence of evidence . . . allows us to feel confident about our observations, interpretations and conclusions" (Eisner, 1991, p. 110). To gain multiple perspectives I used a variety of methods of data collection, in different settings, and over a period of several weeks. I frequently verified my perceptions of the children's meanings with them and with their teacher. I also showed or gave the participants transcripts of interviews and shared my writing with the teacher and

consultant.

Consensual validation means that others who share a similar theoretical background are likely to agree that the description, interpretation, evaluation and themes of an educational situation "are right" (Eisner, 1991, p. 112). I verified my descriptions with study participants. Also, I related my interpretations of the findings to current perspectives in the published literature, and negotiated shared meanings for the research with the individuals on my thesis committee.

Eisner asserts that "the major function of educational research or criticism . . . is the expansion of perception and enlargement of understanding" (p. 113). Qualitative research is *referentially adequate* when others can "locate in its subject matter the qualities the critic addresses and the meanings he or she ascribes to them" (p. 114). Credibility is enhanced by the authenticity of the portrayals of the world of the study participants and by the depth of understanding shown for the meanings they make in their social context.

Data Collection

Field Notes

In qualitative research the natural setting or context is used as the source of data, because human behaviour is influenced by the context in which it occurs (Bogdan and Biklen, 1992). I thus joined the children in their classroom context as well as in the context of the EE Centre. Both in the classroom and at the Centre, I

wrote extensive field notes.

From the beginning I was able to make observations in the teacher's classroom as an observer-participant (Spradley, 1980). In this role I was able to become better acquainted with the children, and their classroom context. After a few days the students hardly seemed to notice my presence in the class. I observed lessons in several subject areas and assisted in the classroom, helping individual students with written work, maths problems or with their social studies research.

The three-day residency at the EE Centre took place from January 29 to 31, 1992. I spent half days in the classroom during the month of January preceding the field trip, and also observed the class for several half days during the two weeks following the trip.

Audio-taped Interviews

The major source of data was the numerous interviews I audio-taped with the children in the study.

I interviewed individual students three or four times prior to the field trip, several times briefly during the field trip, and twice following the field trip. These interviews varied in length from about ten minutes to 35 minutes and took place in a spare room at the school or the EE Centre.

The interviews were loosely structured around pre-planned questions. I tried not to influence the children's responses by asking open-ended questions and then pursuing their lines of thought.

In interviews prior to the visit I explored some of the children's ideas about the following:

-their expectations for the stay in the residence program

-their meanings for environment

-their awareness of environmental problems and their stance toward taking action

-their awareness of their own learning style preferences

I thus attempted to probe the personal context for meaning that each student brought to his or her construction of meaning at the EE Centre.

During the three days at the EE Centre I interviewed each of the profile children several times. Some of the questions I asked were:

- What was the highlight of [the activity]?

- What did you do in the [activity]?

- What did you learn from that?

- What do you think the [activity] was supposed to teach?

- What did you learn about the environment by doing [the activity].

- What is different about learning here at the EE Centre?

At the Centre I found the children to be very accommodating about my requests to hear their responses to activities. I continued the interviews at the school during the week following the field trip.

About seven weeks after the field trip I held final interviews with the

children in groups of two or three. At this time I asked the children if they were still wondering about anything they did or learned during their field trip.

As well as the children, I interviewed the EE Centre consultant before the field trip, and the teacher, both before and after the field trip.

The interview participants were shown or given transcripts of interviews they participated in and were invited to make alterations if they wished.

Other Data

I gathered other relevant data including copies of students' journal entries, parent newsletters, student drawings, and captions written by the students to accompany photos of their visit.

Analysis and Presentation of the Data

Presentation of the data posed some difficulties. It seemed important to relate the children's meanings to the actual games or activities, some of which were complicated to describe. At the same time, the children's meanings seemed to emerge in patterns across activities and experiences. I thus structured the data in two ways.

First, I summarized ten children's meanings for their experiences in the environmental program, in brief portraits. In these I explored some of the significant meanings for each child, and discussed possible influences on this construction of meaning. I also revealed some of the attitudes, intentions and

actions toward the environment for each child, and again theorized about possible influences on these.

Secondly, I selected samples of children's responses to each of the activities or events at the EE Centre. I provided a brief description of the activity and then interpreted individual children's meaning-making for the activity in terms of themes that emerged.

Thus summaries of ten individuals' construction of meaning are presented, as well as a variety of children's meanings for each activity. Emerging themes and patterns united these two methods of portraying the data.

Beginning the Research

Approaching the Environmental Education Centre

After obtaining permission from the school district to conduct the study, I approached Andy Black, the consultant at the EE Centre, to seek permission to conduct the study. Andy expressed interest in the idea. He told me that, although his staff believed the residence programs were providing worthwhile educational experiences, he would find it interesting to see what some individual children were getting out of their experiences. Andy had reservations about what I might find in regard to students' environmental meanings, however. He pointed out that emphasis on environmental studies varied considerably from one teacher's program to the next. Also, he wondered about the time taken to follow the students.

"Three days with us is not a long time. But then, that is what we are trying to find out as well, just what three days will do."

Finding a Teacher and a Class

From the consultant at the EE Centre, I obtained the names of teachers who had bookings to use the Centre in the forthcoming winter season. I was not acquainted with any of them. The third teacher I phoned, Kay Grant, taught a grade five class at Parkland School. She expressed immediate interest in participating in a research project centred around her class's visit to the EE Centre.

Kay mentioned that her grade five class would be going to the Centre with another teacher from the school, Laurie West, and the nine grade five students from Laurie's combined class of grade four and grade five students. Since the two teachers were going to be planning the visit together, I obtained Laurie's permission for her class's participation. I also obtained permission to carry out the study from the principal.

The School

Parkland School is located in a pleasant older neighbourhood of modest homes. The school, a one-story L-shaped building, is about thirty years old. It is surrounded by playing fields. From my first step inside I had the sense of a friendly place. Students in the halls seemed purposeful and polite. Two large charts listing student behaviour expectations were posted conspicuously in the halls. 190 students attend Parkland School, with approximately two classes in each grade.

The Teacher

This was Kay's first year at Parkland School, and her tenth year of teaching. During this time she had taught either grade five or six and described herself as a generalist teacher. She had taken classes to the EE Centre for the past eight years. She seemed energetic, poised and articulate.

The Children in the Study

The children in the study were from the two grade five classes at the same school. There were 20 students in Kay's class and nine grade five students in Laurie's class. I observed the combined group during joint preparations and during the stay in residence.

There were 13 boys and seven girls in Kay's class. Four students spent mornings in a small special learning needs class. The rest of the class showed a range of ability, Kay said.

I first met Kay's class in early December. I briefly introduced my study to the children, and said I would like to interview some of them, with their parents' permission. I volunteered examples of questions I might ask and answered several questions posed by the children. The children's questions included:

Why are you doing this?

Who will read your report?

What if I like my own name? Does it have to be changed in the report?

I responded to this latter question by saying that students involved in the interviews

could choose their own pseudonym.

I sent letters home to the parents of children in both Kay and Laurie's classes requesting written permission for their child's participation in the study. A copy of the letter appears in Appendix A.

Selection of Profile Children

I asked Kay if there were students she might recommend for the interviews. She suggested that I not interview the four students who went to the special learning needs class each morning. In the end, we decided to let students self-select, hoping to recruit those comfortable about participation. I thus began by briefly interviewing all the interested students, about a dozen in number.

I thought it would be important to interview several children prior to the field trip in the event that some might not attend for some reason. As well, I was not certain ahead of time how individuals would respond to requests for interviews while caught up in the activities at the EE Centre. I finally focused my interviews on ten students, including two from Laurie's class.

I decided to draw upon the comments of all ten students for the study because activities at the Centre were fast-moving and I was not always in a position to observe the experiences of specific individuals.

Limitations of the Study

The program that I describe in this study was planned by the two teachers

of the students involved. It is thus not identical to programs of other teachers using the EE Centre. However, it represents a typical winter residence program for students in grades four to six.

The meanings constructed by the students in this study are only generally representative of meanings constructed by other students experiencing similar field trips to the EE Centre. On other field trips to the EE Centre, such things as the teacher's program, his or her pedagogy and context for the trip, as well as the nature of the student group and the season or the weather, would all influence individuals' construction of meaning.

Qualitative studies are limited by the abilities of the participants to communicate their meanings clearly to others and by the researcher's sensitivity to understand and re-communicate these meanings (Eisner, 1991).

Although I made efforts to become acquainted with the students and to reveal their personal context for meaning-making during the field-trip, this was limited through time, and by our separate identities and experiences. I could only surmise the contribution of the children's home experiences to their construction of meaning, for example. My own meaning-making influenced my interpretations of the behaviours I observed, the nature of the questions I asked, and my comprehension of students' verbal responses.

Because of its symbolic nature, the language used to communicate meaning can alter intended meaning or create new meaning (Bruner, 1986). My interview

questions would have cued certain responses from the children while not eliciting others. Vocabulary used in some of the games appeared to hold different meanings for different individuals. Also, the language children used to express the meanings for their experiences may have held different meaning to me as I tried to interpret it. Meaning is inevitably altered further through my writing. Thus the students' own words are frequently provided so that readers may construct their own interpretation from the transcript, and compare it with my interpretation.

Even our best attempts to understand or communicate others' "worlds" of reality or meaning (Goodman, 1978) are tentative in nature, and reflect that meaning is transitory, individual, and socially negotiated (Bruner, 1986).

CHAPTER IV

CONTEXTS OF THE STUDY

Introduction

Children's construction of meaning is influenced by the many contexts in their lives, such as their culture, school and home. Construction of meaning takes place within and across these multiple contexts in a person's life (Bruner, 1986; McKay, 1990). Within each context meaning is socially negotiated (Bruner, 1986) so that meanings constructed in one context may differ from those constructed in another.

In this chapter I describe a few of the many possible contexts within which the children constructed meaning. First I offer some background about the programs and goals of the EE Centre. Then I describe the teacher, her classroom, and the context she established for the field trip within her program and the mandated curriculum.

The Context of the EE Centre

Programs at the EE Centre

The residence programs are only part of a broad range of outdoor education, historical, environmental and science programs offered by the EE Centre. The programs are aimed at grades three to nine. A booking system is used for both the

day programs and the residence programs, which run concurrently. Careful scheduling allows for maximum use of the facility's classroom areas, sports equipment, eating area and the teaching staff.

The EE Centre is operated by a local school board. Staff include three certificated teachers and consultants, and several support staff.

The Centre provides overnight accommodation for 64 people. Residence programs are scheduled so that four classes per week are accommodated through the school year. Each week two classes stay for two-day programs, and two classes stay for three-day programs. Schools usually book two classes at the same time for the residence programs. This requires the involved teachers to plan cooperatively.

The class I was studying took part in a residency of three days duration. A grade six class from another school shared the residency facilities at the same time, but their activities largely took place separately.

Teachers' Use of the EE Centre Residence Programs

According to Andy Black, the EE Centre consultant, teachers use the residency at the Centre in various ways. Most teachers use the residency to teach specific aspects of the mandated provincial curriculum; for example, to introduce, extend or culminate studies of topics in social studies or science. Some emphasize the environmental activities. Some teachers use the residence experience to help knit their class together socially. Sometimes teachers use the booking at the Centre

as a reward for good behaviour at school or as a culmination event before the summer break, but Andy did not think this was an appropriate use of the opportunity.

Residency-Planning Workshop

An important feature of the EE Centre's functioning is that teachers are responsible for planning an individualized residence program for their classes. To do so, teachers attend an all-day workshop prior to the season in which their booking falls. At the workshop, EE Centre teaching staff describe a wide range of possible activities and provide opportunities for teachers to experience some of the activities in which they wish to involve their students. Teachers may also plan their own activities. As well, they have the option of leading many of the activities themselves or can have EE Centre staff lead the activities.

Experiencing the activities beforehand encourages the teachers to lead them during their stay in residence, and also helps them to know what to focus on to promote children's learning. The most popular activities are those which are more difficult to carry out in teachers' own school settings or which entail use of specialized equipment, such as in historical role-playing games and the cross-country skiing.

Before leaving the workshop, teachers write their proposed schedule on timetable sheets provided by the Centre.

On November 21 Kay and I attended a planning workshop at the EE Centre.

In his introductory remarks, Andy mentioned that the school district was trying to stress environmental education and encouraged teachers to consider this when choosing their activities. He asked teachers to be aware of their objectives for using the EE Centre, and also asked the teachers to make these purposes clear to their students ahead of time. He further suggested that in their plans, teachers allot sufficient time for class discussion after the problem-solving activities. Such discussions, he said, help the students reflect on their problem-solving strategies and personal experience of the activities.

Environmental Education at the EE Centre

The first priority of the EE Centre is to develop students' environmental appreciations and responsibilities through experiences in the outdoors with a focus on park, community and city environments. Andy told me that environmental education is interpreted in a broad sense at the Centre. "There is a built environment, there is a city environment, there is an historical environment to this community." However, with the increased environmental concerns of recent years EE staff had made program changes to bring students closer to the natural environment and to emphasize "how they can have more of an impact or make a difference on the environmental difficulties that we are looking at."

Activities at the EE Centre emphasize cooperative problem solving in an outdoor setting. The Centre's philosophy in teaching environmental education, Andy said, was to look for ways that will get children "to see the problem, and

perhaps stir them to action or increase their awareness." Therefore EE Centre teaching staff try to develop activities which are fun but which increase the students' awareness and information level at the same time. The Centre tries to offer activities that make learning personal and meaningful to the children. Andy explained:

> I think the general concept that we are looking for . . . is the magic of the activity. If it doesn't have the magic, if it doesn't catch the interest of the students, then . . . you are not getting a message across.

The social cooperation required to live in the residential situation was also like an environmental message to the students. Andy commented:

> Cooperation is important to us here, because you are living in a social situation, a residential situation. . . .The living situation is a whole lot different than the classroom situation. . . . From an environmental standpoint, if you take this globally, if we are not able to cooperate with other people in our local community, in our world community, well then obviously we are going to have difficulties.

Environmental education at the Centre is influenced strongly by the individual teacher's plan for his/her residence program and by the teacher's thinking and philosophy. Andy commented, "Because it is the teacher's plan and it is the teacher's program, we are limited in what we can insist. We are limited in what we can hope to achieve, from an environmental aspect."

The Centre supports the teacher in ways the teacher requests. Some activities involve the actual study of the outdoor environment, an approach Neal and Palmer (1990) describe as education "about" the environment. Other

activities, such as the outdoor sports and simulation or role-playing games use the environment as a setting for learning, ie. education "in" the environment. Activities which promote education "for" the environment are also offered. The goal of these is to increase students' awareness of environmental issues and concerns, and to model possible actions "for" the environment. For example, EE Centre staff model environmentally-friendly practices, and expect visitors to participate in certain recycling and energy-saving practices.

Andy said that in recent years he has noticed a change of focus in environmental education. The assumption in outdoor education used to be that having positive environmental experiences would automatically lead to responsible behaviour toward the environment but now he feels "we cannot afford to hope for that any more . . . We need to be more specific, more direct." He thus believes it is important to help students discuss and become aware of some of the environmental issues including the negative aspects of these problems. He advocated using any strategy possible to educate people to become more environmentally responsible:

> I believe that we cannot force people to do things they really don't want to do. So we have to educate them, we have to coerce them, we have to make them want to do it. We have to show them that is possible if they have those feelings.

Student Learning at the EE Centre

Students' responses to the programs are quite variable, Andy thought. From working with students and teachers over the years he believed "they get very

positive feelings. They get very positive experiences" doing challenging activities and interacting with others. The most significant experiences are those which are "positive with respect to the responsibility that we ask of them and then allow them to follow through with" such as handling the hosting duties and the dormitory situation. "So we take some solace and some satisfaction in knowing that we are working toward many other things beside the environmental aspect."

The Context of the Teacher and Her Program

The Classroom Context

When I first stepped into Kay's classroom I immediately felt I was in a comfortable, welcoming place. The children gave me friendly glances. Students were seated at desks placed in clusters of three or four except for a few who sat in separate desks facing the front blackboard. Light from the south facing windows filled the classroom. The walls were decorated with colourful student work and charts. To one side of the room a small divider created some privacy for desks drawn up to it on one side and a table on the other. Across the room there was a small three-sided study carrel that was available for any student to use. Students could ask Kay's permission to work at other locations besides their own desks.

I sat at a round table toward the back and observed the lesson. The students looked relaxed and sat quietly or raised a hand to participate in the discussion Kay was leading. This image of an orderly, purposeful class was to remain throughout

my study. As a group, the class seemed attentive and cooperative. They seemed to know what behaviour was expected of them.

Kay explained to me that the class had been particularly challenging at the start of the year. For several weeks she had concentrated on working with the students to help them achieve acceptable classroom behaviours and the calm learning climate now in evidence. She found that these students responded well to consistent routines and a structured approach to behaviour management and learning. Behaviour expectations were posted clearly on a few charts in the classroom. Occasionally Kay would draw the students' attention to these and have individuals read the reminders aloud.

Kay taught distinct subjects according to a time-table. She led frequent discussions with her class about the lessons being taught, and elicited students' ideas. She often had the children work on assignments in small groups in which individuals carried out certain responsibilities according to some rules for working cooperatively in groups posted in the classroom. She explained that she used structure and accountability to assist her in managing a challenging class. Kay also brought these elements of structure and emphasis on cooperative behaviour to her conception of the field trip.

Anticipating the Field Trip

The Teacher's Use of the EE Centre

Kay had taken classes to the EE Centre for the previous eight years. She

valued the residency program at the EE Centre and used it to serve several purposes. First, it provided an introduction to outdoor experiences that some children would not have the opportunity to enjoy otherwise. "The chance to learn in an outdoor environment. Maybe the chance to cross-country ski, or even the chance, the first time, to be away from home for some of those kids."

Secondly, she used the field trip to extend or reinforce aspects of the curriculum. "It complements so well what we are doing." This year she scheduled the residency to follow a social studies unit on the history of the eastern Canadian native Indian tribes and to introduce her next unit on the early exploration of Canada, and the history of the fur trade. She also planned that after Christmas "our science unit will focus on the environment, so again, this is just one more extension of that."

Thirdly, she valued the kinds of learning that were promoted at the Centre:

> I think the kids enjoy learning in a game type of situation. And a lot of kids learn better by doing. . . . So if they can actually simulate the competition between the Hudson's Bay Company and the Northwest Company in the fur trade game. . . . it just makes more sense to them.

Kay had found that some students who had difficulties learning in a classroom setting often responded in positive ways to learning in the outdoor environment:

> Kids that maybe don't succeed very well in the classroom get a chance to succeed outside of the classroom in a different environment. I remember one year we had a little native boy. He had a lot of problems. His dad was a trapper. And throughout the

> year sometimes he did get a chance to tend the trap lines. He came with us to the EE Centre . . . . It was such a great experience for him . . . . He had made a kite and I remember watching him trying to fly this kite out in the field, and it was wintertime . . . That's one sort of picture that stays with me.

She found that the activities provided children with a sense of pride of accomplishment and a rich experience base which both she and her students could refer back to upon return to the classroom setting.

She also valued the social learning that took place through the immersion situation and the activities which required cooperative problem solving. She considered the stay in residence to be a valuable socializing influence on the class. "You get to know the kids on a different level."

Teachers' Planning for the Residency Program

Kay and Laurie met on several occasions to plan details of the field trip. Their decisions were often based on meeting the individual needs of students, such as including a lot of physically active games and activities. The program they planned jointly included historical, environmental and outdoor sports activities.

Together they planned the content and timing of newsletters, the details of their residence timetable and the cost to students. They also decided to acquaint the two classes prior to the field trip through joint planning sessions, outdoor skating, and a mapping activity related to the field trip.

Why Are We Going to the EE Centre?

Kay and Laurie prepared their students extensively for their three-day trip.

Kay explained that such extensive preparation of the students helps them to adjust to the new learning context smoothly and makes clear to them the teachers' objectives for the trip. She said, "Hopefully, all the planning and preparing ahead of time will help. Because that way they really know. They know what to expect, and they know what I expect, and what Laurie expects, so there are no surprises for them."

Before Christmas they sent home an information letter describing the cost, clothing requirements and the objectives for the residence program. The objectives listed were:

1. To give students an opportunity to experience learning in an outdoor environment through a variety of activities.
2. To develop an awareness of our responsibility towards the environment.
3. To learn about the impact of the fur trade and exploration on Canada's history.
4. To enhance personal and social growth by living and working together.

In this letter Kay also briefly introduced my study to the parents. The relevant paragraph appears in Appendix B.

Two further letters were sent home in January. These letters provided additional information and a detailed itinerary. A schedule of activities and times appears in Appendix C.

Early in January Kay held a discussion with her class about their purposes

for going to the Centre. She asked, "Why are we going to the EE Centre?" Some of the students' ideas were:

To learn more about the environment.

Learn about activities outside.

To get away from school.

To learn about the fur trade.

To learn how to be together.

To have fun.

As the students offered their ideas, Kay edited them and wrote them on the board under the question, "Why are we going to the Environmental Education Centre?" She added the objective, "To learn to cooperate and work together." She asked the students to copy the seven objectives she had listed into their EE Centre journal booklets.

EE Centre Journals

The journals, designed by the Centre, are small photocopied booklets which provide a structured format for students to record both their anticipation of the trip and their personal responses to experiences there. Some of the headings in the journal included:

Why I am going to the EE Centre?

What does "being responsible" for the environment mean to me?

My environment includes . . .

Three things I can do to help the environment are . . .

While at EE Centre I cooperated with classmates by . . .

I felt closest to nature when . . .

I'll never forget . . .

I didn't think I could, but I did . . .

What does "being responsible" for the environment mean now?

During this class the students wrote down the names of two classmates with whom they would feel comfortable sharing a room.

What Does Being Responsible to the Environment Mean?

The following day Kay asked the class, "What does being responsible for the environment mean to you?" Some of the students' ideas were:

Having a clean place to live in.

Try to stop pollution. Try not to drive your car as much as you want.

Take the bus instead of a car.

Stop burning down trees.

To not kill all the animals.

Recycle.

Kay followed up some of these ideas further. The students' ideas reflected awareness of some of the issues highlighted by media, and were simply expressed.

She then asked the students to write some of their ideas about environmental responsibility in their journals and to decorate the covers using the same theme.

Several of these responses referred to clearing up litter or using alternative ways to power vehicles. A variation was, "To keep our earth from turning into a toxic waste dump." One boy seemed to link environmental responsibility with rules for school conduct. He wrote in his journal, "In the wintertime do not throw snowballs." Another student wrote, "I feel that I have done more than my part of helping the environment because I have to do what the other people forget, such as recycling and cleanig up garbege [sic] off the ground!"

Another day Kay led the class in a discussion about environmental problems and afterward asked the students to write in the journal some of the actions they take to "help the environment." Most students again mentioned picking up litter and recycling.

Behaviour Expectations

Kay and Laurie brought their classes together on January 13 and 16 to discuss behaviour expectations for the dormitory situation and the visit in general. The teachers invited students to discuss appropriate behaviours for various situations asking, for example, "What are some of the things we need to do to make our meal pleasant?" They helped the students propose strategies to solve small problems when they arose. They then summarized the suggestions into "showing respect for others," and "making efforts to cooperate." Students asked several questions, which centred mostly on the freedoms and restraints which would apply to their behaviour there. Such socialization of students is a primary

goal of schooling, often achieved at the expense of inquiry approaches to science and environmental education (Stake & Easely, 1978; Robottom, 1987). Stevenson (1987) asserts, "The organisational conditions and the demand for covering material compel teachers to be concerned, first and foremost, with maintaining order and control in their classrooms" (p. 76).

On January 21 the classes met again for an orientation to the EE Centre given by Andy, the consultant. He began by asking the group, "I'd like to know why you as a person are going." Some of the responses were: "Have fun." "To try to do neat things." "To learn about the environment." "To learn how to get along with people." When someone said, "To get out of the house for a few days," he reminded the students that the EE Centre was still school, and that "we have expectations for what you are going to do and for your behaviour." He explained further that people who come to the EE Centre find out what it takes to live away from home and "to share a living space."

Andy described some of the environmentally friendly behaviours that are encouraged at the EE Centre, such as not wasting food, recycling, using a compost and being thrifty with use of water and electricity. He also showed slides of the EE Centre, discussed clothing requirements and described the EE Centre staff members and their roles at the Centre.

Where is the Environmental Education Centre?

The following day Kay and Laurie told the children who their roommates

would be and brought the classes together to do a mapping activity in these groups. Each group was given city road map and had the task of locating the EE Centre and determining routes to get to it. This activity gave students the opportunity to make sense of where the EE Centre was located in the city.

The Curricular Context

Social Studies

During the month preceding the visit to the EE Centre, Kay's class studied the history of Canada's native groups. Her approach was to first have all students gather some general information about the life style of the native groups and to share this. Students used worksheets to help structure their research in the various resources that Kay had gathered, such as library books, filmstrips, texts and large museum posters of native artifacts. They located six major Canadian native groups on maps, and wrote some brief information about each of the groups. One day they shared their information and Kay summarized it on the blackboard. They then compared and contrasted the different native groups' modes of travel, clothing and shelter, and their food-getting techniques. Kay emphasized the natives' struggle to survive, a theme which later arose in the children's ideas about the fur traders and natives from their activities at the EE Centre.

The latter half of the unit involved students working in small groups to research and write group reports on different native tribes. Kay began by having the class brainstorm questions or topics they could research about a tribe. "What

are some things you would want to know about the Micmacs, for example?" She used some of the children's questions as headings to guide their research. The students could choose the tribe they wanted to study, and this choice helped determine the small research groups.

Kay provided an outline with clear expectations about headings, content, illustrations etc. for the reports. The students then had several social studies periods to carry out their research. Kay and I assisted the students in locating or editing some of the information. Kay also helped the children think about evaluating their progress on the reports. She asked, "How do we know when we have found enough information?"

Science and Environmental Studies

During science classes prior to the stay in residence, Kay and her class examined the issue of waste disposal. She used material from a recently-prepared unit on waste management (A Matter of Waste, Alberta Environment Education Branch, 1989). These lessons were mostly of a discussion nature, followed by having the children answer questions on worksheets.

In these discussions, the students shared general ideas about the location of waste sites, the breakdown of various materials in waste dumps and the effects of dumping waste materials in water. The children's solutions included, "We can make it into something that is less hazardous," and "Dig a hole, fill it up, then cover it then dig another hole." Kay encouraged the children to offer a variety of

ideas and to comment on each others' ideas.

The children showed particular interest in an activity which involved taking home a questionnaire to interview family members about how various waste disposal matters were dealt with.

One day Kay invited the school custodian to come in to talk to the class about the disposal of the school garbage. The children seemed fascinated to hear about the diverse solutions and destinations for school waste. The custodian had strong views about people taking responsibility for dealing with waste and pollution. He told the students that they needed to "do something" to make solutions where adults failed. "You guys are the ones that can make it change." This caused quite a stir. Several students proposed solutions for the waste problem whereas others responded with indignation: "You adults should have stopped this." After the discussion the class went to the school boiler room to examine the school incinerator.

Back in the classroom the significance of the custodian's visit became evident when some of the students asked Kay what they, as children, could really do. She said, "What we are doing right now is becoming more aware." She then wrote on the board, "We can: think / get ideas / carry through / look back."

This discussion with the custodian was yet another confirmation to the children that environmental problems were real and serious. His blunt messages no doubt contributed to some of the children's anxiety about their future. Kay's

response was reassuring with its empowering message that becoming aware is an important first step to problem solving. Solomon (1990) emphasizes that class discussion of environmental issues helps to clarify the issues through "a process of verbal and social reconstruction" (p. 117).

The activities and discussions in this science unit quite likely contributed to the emphasis students placed on concepts about waste in their constructions of meaning about environment.

After the Field Trip

The Teacher's Follow-up to the Field Trip

During the week following the residency at the EE Centre, Kay encouraged her students to reflect upon their experiences and learning there through class discussions and by writing entries in their EE Centre journals. They wrote captions for an album of photographs of their experiences.

Kay told me that, after the field trip, she noticed that students linked current classroom learning with meanings constructed during experiences at the EE Centre. Their experiences in the historical games emerged in social studies discussions during the next unit on explorers, for example. They seemed to be more aware of the hardships and problems the explorers might have faced from their personal experience in the EE Centre activities. As well, the class had talked about different ways to reduce waste and had incorporated the idea of using cloth towels instead of

paper towels in the classroom. The field trip appeared to have made an impact on the students' environmental awareness and motivation to take action.

The Teacher's Evaluation of the Field Trip

Kay thought the residency program at the EE Centre had been a success. She felt the students had achieved all her own objectives for them, including the social and cooperative learning, environmental learning and "certainly the historical objective." The environmental experiences had given the students "a broader awareness of our environmental responsibility."

She was especially pleased by the students' behaviour during the residence program. She and Laurie had emphasized their expectations for cooperative and courteous behaviour, and felt that the students had met these.

She could tell that the trip was important to the students from class discussions, their journal writing and "the interest that they took in looking through the photo album we put together as a sort of summary."

Summary

This chapter describes several contexts which the students in the study experienced and which had potential to influence their environmental meaning-making.

The environmental education context at the EE Centre is largely determined by each teacher's choice and interpretation of activities. Social and cooperative

learning receive a strong emphasis in all activities. The EE Centre, because of its location within a city, can offer only limited experiences in nature study or ecology study. However, EE Centre staff model environmentally responsible practices and discuss current environmental issues with students in very direct ways. Students are expected to participate in environmentally friendly actions as well.

Kay chose activities at the EE Centre which supported the social studies, science and physical education curricula. Prior to, and following the field trip, she provided classroom instruction relevant to the field trip.

The students' classroom context was characterized by firm behaviour expectations and cooperative learning in a structured setting. Students had opportunities to make choices within the structured framework. Kay regularly elicited students' ideas and provided occasions for them to share these.

CHAPTER V

PORTRAITS OF THE CHILDREN'S CONSTRUCTION OF MEANING IN THE ENVIRONMENTAL PROGRAM

Introduction

In the past chapter I described the contexts of the EE Centre, the children's classroom, and the teacher's program, all of which would influence the meanings constructed by the students.

In this chapter I present brief portraits of each child's personal world for meaning-making about environment. In these portraits I explore the understandings and awareness each child held about environment, his or her attitude and stance toward environmental problems, and evidence of his or her intention to act for the environment. I describe what seemed to be the important meanings each child constructed about his or her experiences on the field trip and suggest some of the possible influences upon this meaning-making. In the discussion following the portraits I comment on some of the commonalities and contrasts in the children's environmental thinking and attitudes.

The primary goal of environmental education is to increase citizens' motivation to act for the environment (Hungerford, Peyton & Wilke, 1980). Realization of this "super-ordinate" EE goal (p. 43) involves reaching other important EE objectives. These include helping citizens to acquire environmental

awareness, basic knowledge and understanding of the environment, a positive attitude for active participation in environmental improvement and protection, and skills for identifying and solving environmental problems.

In these portraits of individual children, I comment on the extent to which the above factors seem to be part of the child's construction of environmental meaning for the activities at the EE Centre.

The Portraits

Daymon

This was Daymon's first year at Parkland School. He was still struggling to establish himself in the social setting of the new classroom. He spoke nostalgically about his life in another school where everything, he claimed, was much better. He was the smallest person in the class. He had well-developed verbal skills which he seemed to use to compensate for his small stature. His acid remarks and idiosyncratic viewpoints sometimes distanced him from other students. To help him concentrate on his school work, Kay had him sit by himself at the front of the class instead of with a group.

Through interviews and classroom observations I found that Daymon was a "character." He was quick to notice the humour or inconsistencies in situations and described them with irony. He was perceptive about human nature and used creative language to describe his world.

Daymon liked playing ice hockey, collecting hockey cards and playing outside. He went camping a lot and liked to fish and swim. He appeared to be interested in nature, perhaps influenced by his camping experiences. He enjoyed reading fantasy and projecting himself into the hero roles.

Daymon had not been to the EE Centre before. His expectations of the field trip centred on his interest in the outdoor sports. "They tell you it's really fun there because you get to go cross-country skiing, snowshoeing and skating." He also added that he would like "to learn about nature and animals." Tied to his thoughts of the field trip were a few private concerns about not returning home for three days because, he explained, "Mom gets lonely."

Daymon explained his conception of environment in terms of human relationships. "Everybody has an environment, because their family is their environment. Your environment is your home, your family and everything that matters to you." He then added, "It means living and non-living things around us." Daymon's family was separated, so perhaps that is why his first connection to the idea of environment was to think of the family environment. Daymon suggested that what mattered most to him was his family.

He appeared to have a good understanding of some environmental concepts. For example, studying owls in science in Kay's class had helped him construct a concept of how living things are connected and inter-dependent:

> We were studying about owls not even a month ago. And say you killed a mouse, a vole . . . and that was the only vole left . . . other

> animals would die . . . and if that has predators it will be a chain and everything will die.

Daymon understood that affecting one area of nature influences other areas. He then made the following comparison to illustrate this concept: "Everything will be just like a train. If you do something to the front engine, the whole train won't move, because the engine is connected." Perhaps Daymon's interest in reading fantasy helped him to think metaphorically.

The highlight of Daymon's stay at the EE Centre was his successful experience as a leader on the David Thompson Climb (p. 96). It was the sort of hero role he had imagined for himself and was a confidence building experience. Perhaps because of his immaturity, he had some social difficulties during the stay, and was the only student to tell me he did not fully enjoy his visit.

Daymon's views on environmental issues were interesting. Although he seemed to be aware of various environmental problems and showed a good understanding of the underlying science concepts, when we discussed the environmental meanings that arose from his experiences at the EE Centre, his stance was to disassociate himself from personal responsibility to take action on environmental problems.

He understood from the games at the EE Centre that teamwork was needed to solve problems, as in sports, but did not seem to relate this to the need for teamwork to solve environmental problems. In one of the Initiative Tasks (see Appendix G), the fabricated scenario of "crossing the toxic waste dump" was a real

possibility for the future, Daymon reckoned. When I asked him, "Do you think the world will be like that some day?" he answered, "Yeah, if they keep on polluting." His use of the third person pronoun "they" suggests he distanced himself from personal involvement in the problem. He said he did not worry about pollution because, he explained, the mayor was trying to recycle. He was aware of global environmental problems, but believed that someone else (adults, the government, others) would do something. When discussing such environmental issues he seemed to stay emotionally distanced from feelings of concern or anxiety, and sometimes repeated slogan-like generalities. He said, for example, "If we quit polluting we will probably make the world better. If we quit polluting the world it might be good for our children and their children." Daymon's concerns about his separated family, about making friends at his new school and about compensating for his smaller size were closer to him and more relevant than environmental concerns.

He thought staying over in the residence program helped kids "learn stuff that they didn't know before about the fur trade and the environment. And they learn how to respect each other's feelings and to live with them."

Melanie

Melanie was a tall shy girl with a friendly smile. During interviews she often answered my questions with very brief responses and was not a major

contributor to class discussions. Her friends and her social life were important to her. She was particularly pleased that Laurie's class was also going to the EE Centre because her best friend was in the other class.

She enjoyed reading, outdoor sports, Highland dancing and hiking in British Columbia in the summertime.

As far as taking action on environmental problems, Melanie seemed to be a follower. She was influenced by her friends and their values. She participated in environmental action if that seemed to be an acceptable or desirable activity in her peer group.

Melanie had not been to the EE Centre before. Before going, she said she was looking forward to doing "lots of outdoor stuff" there. She had heard from another student who had gone before, that "they kind of cleaned up and helped the environment and they planted new trees." All this appealed to her.

When I asked Melanie what the word "environment" meant she reflected for a moment then said, "The word environment means to me, keeping the litter in the garbage and cleaning up." When I asked her, "What is environment?" she seemed a little unsure. "I don't know. The place around us? That you live in?"

Melanie did not seem to have a well-developed understanding of environmental problems or the science concepts needed to understand the issues. She focused on the problem of litter. She seemed to define "litter" as something that should be kept in the garbage, but she did not then seem to wonder what was

to become of the garbage. Her concept of taking environmental action was to pick up litter. Likely her understanding of waste removal and its issues broadened during the class's study of waste management.

What things should children learn about environment? Melanie suggested, "They should learn to keep it clean and make sure it's cleaned up and not cut down trees." Melanie said she sometimes worried about environmental problems and expressed her concern in terms of garbage: "I want to live in a place where it is clean and not full of litter."

For Melanie, the most important thing about going to the EE Centre was the social experience of staying two nights with her friends. "Just being there with each other was the main thing."

Melanie said she knew very little about the fur trade before going to the EE Centre, but the many games and the outdoor experiences made the fur trade history come alive. "When we were doing the fur trade it was in the winter, and it was just easier to imagine than being in a room." She also constructed new meanings about ecological concepts from the games. For example, she remembered from science class how animals escaped the notice of their predators by staying very still and was amazed when this strategy worked for her in the Animal Survival Game (p. 107).

Prior to the stay at the EE Centre, Melanie did not appear to think much about environmental problems outside of school contexts where she seemed to

approach the topic as a theoretical classroom exercise. She thought, however, that her experiences at the EE Centre had increased her environmental awareness. She enjoyed the Environmental Bingo Game (p. 90) and thought the game was "probably trying to teach you not to just do it there, but to do it all the time." The game taught her that recycling, and saving water and electricity were activities that were helpful to the environment. Thus her understanding of ways to take environmental action broadened. After immersion in a situation where environmental responsibility was emphasized, she found herself noticing the amount of litter in parks near her home and expressed concern about people's careless attitudes. Her awareness of environment, even though at a simple level, was increased through going to the EE Centre.

Janet

Janet had an optimistic and positive attitude toward life. This became quickly apparent as we discussed her interests. She enjoyed all aspects of school. One of her favourite subjects was science "when we get to do these experiments and find out the results." Her interests included reading, tag and soccer.

Janet had not been to the EE Centre before. She was just a little uncertain about what to expect of the field trip because after the talk given by the consultant from the EE Centre, she had a picture in her mind that there would be a lot of teachers telling the kids what to do and that the students would not be allowed to

touch things. She also wondered if she would get enough to eat.

Contrary to her expectations, the visit to the EE Centre was both "fun" and interesting. She spoke enthusiastically about her experiences at the EE Centre. Her assessment was, "They chose good activities. But they knew kids. They must have known kids would like these activities, that's why they chose them." Janet voiced the importance of making learning events relevant to the learner, an important criteria to promote construction of meaning (Pope & Gilbert, 1983). She also paid compliment to the EE Centre's efforts to bring the "magic," in the words of the consultant, to the activities offered.

Janet acknowledged the value of role-playing to learn, and explained how it helped her remember information and construct meaning. She thought that acting out the possible roles of people in history helped her to understand what their experiences were really like. She explained, "You were doing, you were experiencing what they did. You were being a fur trader and doing what the fur traders did. It helps you learn better. It's a lot funner than just writing stuff down."

Janet's positive attitude toward learning and her lively curiosity ensured that she entered fully into the spirit of the EE Centre activities. Because of her active involvement she came away with a wealth of new meanings and good memories. She said that, before going, she had little prior knowledge of the fur trade. She had not known the names of the fur trading companies or what was involved in

trading. She described in much detail the new understandings of Canada's history that she constructed from playing the active games and hearing the talks. The imaginative aspects of the games appealed to her. For example, she found she "thought as an animal" during the Animal Survival Game (p. 107).

She also gained important social meanings through her experiences. She felt that living together for three days helped her make important bonds with her roommates. "You get to know people better by just staying with them for three whole days. . . . Mostly the kids in your group were so nice they were like your family."

Janet's concept of environment was both as a place and as a commitment. "Environment is the outdoors. It's about saving the world and everything." She too, projected an awareness of living in a polluted world. She observed, "The environment is, garbage . . . You usually don't pick it up, but now you have to, really. And it doesn't take much time to pick up all the garbage."

In talking with Janet I found that she was aware of several current environmental problems and could give reasonably detailed descriptions of their causes and effects. She said she often discussed news items with her mother. When I asked if she worried about such environmental problems she said, "Sometimes. Like the landfill. I don't get much time to think about that but when I do I worry about it." She had focused on an environmental concern which she could relate to from her personal experience. It would seem that her positive view

of life helped her to deal with the depressing environmental concerns in fruitful ways.

That is why, perhaps, she talked about the Environmental Bingo Game (p. 90) as being of special interest and meaning to her. She said that the game had made her think about more ways to recycle or take personal action to contribute to solutions for environmental problems. "They made recycling a lot of fun." She thought the EE Centre helped kids "learn how to clean up the world and everything." She seemed to understand that working as a team to complete the Environmental Bingo at the Centre provided a model of how to work toward solutions for environmental problems. Teamwork was necessary, "because one person couldn't do it all."

Becky

Becky approached life seriously. I observed that she worked conscientiously in class and finished all her assignments. She told me she always played games by the rules. At home she did a lot of chores around the house and earned her allowance this way.

She was interested in animals, especially horses. She mentioned that she particularly enjoyed playing outdoor sports, often joining the boys at baseball or soccer. She liked the outdoors, and enjoyed camping and swimming in the country.

She often went for walks in a local ravine with members of her family. They frequently saw deer in the ravine. The creek running through this ravine was polluted from a nearby oil refinery. One day last summer Becky and her father had found a dead deer in the creek and Becky wondered if it had died from drinking polluted water. The next evening they saw a fox family feeding on the deer carcass. They did not see the foxes again and Becky wondered if they had died too. She wondered if the water had poisoned the deer, and the deer had poisoned the foxes.

Becky was not confident about her friendships with other girls. She admitted that there were some difficulties. She said, "Kids do think I'm unusual," and believed it was because of the clothes she wore. She mentioned that she was worried about a grand-parent who was hospitalized. She seemed to welcome the extra attention of participating in the interviews.

When I first talked to her, Becky said she thought the grade fives were going to the EE Centre because it was a privilege they had earned by keeping their school neat. Becky had gone the previous year, and looked forward to playing the Environmental Bingo Game (p. 90) where students "pick up trash and clean the neighbourhood." She also expected to play "a giant tag game" in the woods, and this year, to try skiing and skating.

Becky's serious approach to life was reflected in both her attitude to the environment and her description of her experiences on the field trip. She expressed

concern about environmental issues, especially the issue of garbage. She believed pollution from garbage was serious and worried about the consequences. She mused:

> It would be nice to go back into the past and see what the environment looked like before it was, everything was polluted and there wasn't garbage in the ravines and water, and animals aren't dying because of the water being too polluted.

She held a strong image of living in a spoiled world. Her observation of the dead deer in the ravine seemed to have made an impact, and figured in her constructions of pollution. When I asked her, "Do you worry about environmental problems?" she said, "The most thing I worry about (I don't worry about this too often) is the animals getting killed because the water is poisoned by chemicals and the water isn't very clear."

Becky told me she was trying to help the environment by picking up litter every day on her way to and from school. She said that other children sometimes asked her why she picked up the litter. They thought this was unusual behaviour. She said, "They're not accepting very much. They keep on littering and I'm still picking things up . . . . They're just not interested in it." Despite her effort, she felt helpless about stopping the garbage problem and was pessimistic about the future. She lamented, "They're trying to find another place where they can put more garbage but no-one really wants to and recycling won't work very well."

Becky's social experiences on the field trip seemed more significant to her than the environmental activities. She said she felt rejected when she learned that

one of the girls had reacted negatively to being placed in a room group with her. I noticed that she and her room group had occasional differences of opinion to work out too, which Becky probably found stressful to deal with.

She made positive remarks about the experience as a whole (eg. "It was fun!") but sketched few details. I wondered if it took all her energy just to cope with the physical demands of the activities so that she did not reflect much on the possible ideas behind the games. She had found the David Thompson Climb (p. 96) tiring for example. When she could not recall any information from the historical presentations she explained, "I'm not very used to seeing slides." She seemed to find the skiing difficult. She said, "The hardest part was getting up one of those stupid hills. I couldn't catch up with anyone."

On the last morning when I asked her a casual question about an activity we had just completed, she told me she was worrying about her grandmother. I wondered if her personal concerns affected her perceptions of her field trip experiences and contributed to her anxiety about environmental issues. It seemed to me that her outlook on environment reflected a lack of confidence about herself. She seemed to feel helpless about controlling her fate on a personal level and projected these feelings of ineffectuality to environmental concerns. In describing the Animal Survival Game (p. 107) she said, "That's the exact same life as a normal animal like a deer or a moose . . .It doesn't have much success getting water and food and shelter." Again, she seemed to be thinking of the image of the

dead deer in the creek in the ravine.

John

John said he enjoyed school, sports, reading, baseball and biking. He also enjoyed working on research projects in class. During social studies John and his group seemed to get deeply absorbed in their research. I noticed that he listened closely to class discussions and frequently contributed. In class and in interviews he reflected thoughtfully about ideas discussed in class.

Other contexts besides school influenced John's enthusiastic interest in the environment. He mentioned that his family frequently discussed environmental issues at the dinner table, especially now that his sisters were studying this in junior high. He made his own contributions to the discussions. "Every day that I have science I start saying what we learned." He also enjoyed spending time at the family cabin at a lake where he often observed wild animals. "When I'm on a bike ride I like just stopping and watching . . . . I passed a snake before and it was just a little family I think, crossing the road."

John had thought about being a brain surgeon when he grew up "but I think now I'd like to be a scientist and find out ways we can save our environment and things around us." He thought that this might involve learning about chemistry and thinking of ways of doing things that do not cause so much pollution.

He had not been to the EE Centre before. His expectations of the visit to

the EE Centre included learning about the environment and getting "to know other people that you don't really know."

"The environment to me, is the place that I live in and what's surrounding me." John had heard that there were some serious environmental problems, and told me that he sometimes worried about them:

> It does cross my mind. When I'm at home or just in school working on some of these projects . . . . Like what I was talking about the ozone. I'm afraid that it's going to start killing everybody and then it might harm my family and my relatives or something. And sometime, it is just going to destroy our world.

His meaning for environment also included the social environment. He mentioned that a neighbour who is a police officer told him that he had heard that some people were trying to sell drugs just down his street. John was concerned about both his social and physical environment but believed in trying to solve the problems. He had already been thinking of environmental solutions. He said, for example, "I've thought of things that we could do to protect ourselves. Like, stop making so much pollution. Right? And like, to make a patch for the ozone until it comes back together." As well, he thought that the neighbours should get together and tell the "drug sellers" to leave. His approach was to advocate action, to be assertive and to act to protect the local environment. John mentioned that his grandfather had been a civic leader who took action about problems. Perhaps this helped John believe in himself as a problem-solver and helped him form his intention to act.

John's concerns about global environmental problems were increased through some of the things he heard while at the EE Centre during post-game discussions. He explained, "Before, when we were talking about the environment, I wasn't really worried about it, but after what we had learned there, like, what we are doing to our environment, I am just more concerned about it."

John said that the cross-country skiing had been a highlight of the stay for him because "it was just a challenge to go down all those icy hills" and because he had been the leader of his group. He enjoyed both challenge and leadership.

From his experiences he constructed a rich variety of historical, ecological and environmental meanings. Experiencing the David Thompson Climb (p. 96), for example, reminded him that "everybody has got to work together if we want to accomplish something." In the game, How Many Bears in the Forest (see Appendix E) he learned about the survival of the fittest, how "if there's a really big and strong bear, it's probably going to last through the winter and live quite long." He thought the Initiative Tasks (see Appendix G) told him "about some things we are doing to our world."

Some of the activities left him puzzling though. He wondered about the existence of Sasquatches and also, whether there were supposed to be links between the environmental activities and the fur trade studies.

Monique

I did not meet Monique the morning I first met the rest of the class. The school secretary told me later that Monique had had an argument with her friends and may have been absent because of that. It seemed that, like many grade five girls, Monique had her ups and downs with her friends. The following morning, when she heard that I was interested in talking to students about the environment and their upcoming field trip she came up and introduced herself. She told me that she most definitely wanted to be included in the interviews because she was very interested in the environment. This turned out to be so. Monique was somewhat of an environmental activist. She expressed strong views about the need for people to become informed about the environment and to take action. I found her interesting to talk to. She seemed enthusiastic, emotional and sincere in her concern.

Monique enjoyed tap dancing, ballet and sports. She was interested in the environment because, she said, "I like learning about all the different kinds of trees and all the different kinds of animals." She got some of her ideas from television. "I watch all these science shows and try to pick up some stuff."

Seeing a television program on the rain forest had started her thinking about taking action. "And I thought . . . when I grow up I want to save all these trees." When the blue box recycling program was first started in the city, she took charge of recycling for her family:

> My dad, he doesn't really care, you know? It's like he throws cans and stuff into the garbage. I take them back out when he is not looking and throw them in the recycling bin.

She had formed environmental clubs with her friends, and kept a list of environmental action plans that she intended to carry out sometime.

Monique expressed several opinions about taking environmental action. She thought that governments were promoting recycling, not because they were so worried about pollution, but because of political pressure. "I think they are just doing it because all the public thinks they should." Her outlook was not optimistic about people's efforts to control pollution. She said, "I don't think we will ever clean up." She did not think the advertisements she saw on television would help increase people's motivation much because "you have to do it on your own . . . You need to be into it."

She suggested that children could do a lot of things about the environment. They could put their candy wrappers in the garbage instead of on the ground. They could re-use materials, perhaps by making crafts. Their parents could carpool to work, because, "at rush hour there's fifty thousand cars and there's one person in each car."

Monique seemed well informed about several current environmental issues. Some of her concerns derived from first hand observation of water pollution. When I asked her how water became polluted, she gave an example from her personal experience:

> They just throw it all into the river. We took a drive down the river once, in a boat, and we were going down there, and we saw a car laying on the side. Tires, pop cans, broken glass. Everything you can imagine. Just all on the sides and in the water. It's like, how can fish live in that any more? It's too spoiled.

She was worried that "some day there's going to be nothing left . . . and garbage is going to be piled up to the sky and it's just going to be horrible."

Although Monique spoke so dramatically about the damaged world she found herself in, when I asked her if she worried a lot about environmental problems, she did not admit to great anxiety. She said she was worried "a little bit." Perhaps by taking all the action that she did, by gathering more information and by verbalizing her concerns, she managed not to internalize anxiety about the environment. Her concern seemed to be more at an intellectual level. Her dramatic descriptions implied emotional concern, but as I grew to know her better, I thought the things that concerned her most were her relationships with friends and her family.

Monique had not been to the EE Centre before. She had heard that going to the EE Centre "helps us to learn how important the environment is and if we don't take care of it there's going to be nothing left." She also said, "I'm looking forward to cross-country skiing and going with all my friends into the dorms at night and fooling around until, like, 10:30."

I wondered what would be the most significant things about the stay at the EE Centre to a person like Monique who seemed so environmentally motivated.

While we were waiting to leave the Centre on the last day I asked her what had been the highlight of her stay. She said, "I met a boy named Cory here. And I got his phone number. And his picture." It would seem that her interest in issues about the natural environment was shifting to interests in her social environment. A few days later back at the school, I asked the same question. This time she mentioned three highlights of the trip (including meeting Cory, who was with the other visiting school). I asked her how she would rank those three highlights. Monique said, "Oh, I would say, first comes cross-country skiing, then comes Cory and then comes the solo walk." Cory had slipped to second place to cross-country skiing. I wondered if her interest in environmental issues would be sustained in adolescence.

There were other important social meanings for Monique in the residence stay. She enjoyed being with her room group. As she had planned to do, she and her friends "fooled around" and threw stuffed animals at each other after lights out.

She told me that teachers and students learned something important by staying overnight all together. "They can see if they actually can cooperate." This comment acknowledges the important social goals of the EE Centre which Andy, the consultant, had discussed with me. Also, she thought the residence experience helped students become more self-reliant. "You have to know when to brush your teeth. You have to know all this stuff. You have to know how to take your medicine. . . . Our mom and dad weren't there so we had to be responsible."

Monique constructed rich meanings about her experiences in the activities at the EE Centre. Her interest in and prior knowledge about environmental issues undoubtedly contributed to this. This was evident in her perceptive interpretations of the concepts presented in the activities.

She thought that learning in the outdoors was meaningful. "If you want to learn about the environment it's better to go outside."

She also seemed to understand several of the intended analogies and environmental metaphors presented through the games. In the Animal Survival Game (p. 107), she learned that "animals have it very hard. We only played that for about an hour but all the time the animals have to be on watch." This concept seemed significant to her.

She tried to link the historical and environmental themes. She thought about how the natural environment has changed so much since David Thompson's time, and wondered if we could learn from the past. She wondered what environmental message David Thompson would give the "kids of the world" if he could speak to them and tell them "how the world was like before all this pollution and stuff came."

Monique was pleased to visit a place where there was such interest in environmental themes. "I love the EE Centre," she enthused. Going there validated her own efforts to take environmental action. She was particularly impressed by the environmentally friendly behaviours of the Centre staff.

"Anybody that I know, they care about the environment, but they are not like that!" Later, however, she wondered if the EE Centre staff sometimes lapsed in their efforts to do these things, as she herself sometimes did. She admitted that sometimes she found it difficult to live up to her own good intentions:

> I make up this chart at home, all this stuff I am going to do about the environment. The next day, or two days later, it is sort of like, I don't want to do this any more. I'm too busy, and I just don't want to.

"I want to know if they just do this while they are at work . . . like a play." She added, "I want to help the environment but . . . sometimes I forget, and other times it's just like, you need to run the water." Like many people, Monique had found that carrying out such actions involves an effort, and is not always convenient or comfortable.

Nevertheless, Monique believed that environmental problems were serious and required action from the public. When we were about to leave the EE Centre, I asked her what would help make people become more environmentally responsible. She said people should be "getting out of their little daydream and looking at what the world really looks like and that might help them change their mind." I thought this was a very perceptive remark.

Mark

Mark was interested in sports and his school studies. He was a quiet, soft-spoken boy and was popular with the other boys. He spoke slowly and shyly

during interviews. His responses were detailed and clearly expressed. Of all the students in the study Mark seemed to have the most well developed understandings of concepts about environment and ecology. When I asked him what sorts of things kids should learn about environment, he suggested they learn:

> That some animals sort of have to blend in with the environment so that they have a better chance of surviving in the wilderness. And that the animals have to protect themselves from their predators so that they don't get eaten up.

It is interesting that his idea of environmental studies included learning about ecology concepts. Several of the children focused more on the over-riding environmental problems such as waste in their view of environmental education.

Mark had been to the EE Centre the previous year. He had especially enjoyed hosting at the table, going for a hike and playing environmental games. He recalled many details about the activities he experienced and the environmental concepts he had learned. He said the games taught him "not to destroy animals' habitat because they had to have a home too." He also learned "how animals survive in the wilderness." Perhaps then, his broader concept of environmental education was influenced by his previous year's experiences at the Centre.

He was aware of various environmental problems which he explained in considerable detail. He told me he thought he learned most of his information about environmental problems from school or from television news clips. He did not worry about these problems, but said he did want to learn more about them so that he could "help save the environment."

His expectation of the visit to the EE Centre this year thus was "to learn more about the environment."

Mark's descriptions of his experiences after this second visit were also detailed, and he seemed to have a fuller understanding of the game concepts than many other students. Certainly, experiencing some of the activities such as the Animal Survival Game (p. 107) a second time gave him an opportunity to construct further meanings. For example, he commented that it was more difficult to hide in the woods in the wintertime when the branches were bare than the previous summer when there were leaves on the bushes. This experience contributed to his understanding of how difficult it was for animals to find cover in winter.

Both Becky and Mark had experienced a residence stay at the EE Centre the previous year. It is interesting that, whereas Mark had constructed a rich repertoire of meanings related to the curricular contexts on the first visit, Becky seemed not to construct the intended curricular concepts in much depth either time. Perhaps she lacked enough background or prior knowledge to understand the intended concepts fully, or perhaps her social and emotional needs focused her attention elsewhere.

Several activities were new to Mark this year, however. He had not participated in the cross-country skiing or the historical activities the previous year. He found these particularly interesting. The cross-country skiing was significant because it posed a personal challenge. "I could make it to the top of those hills

because I thought I couldn't."

From the historic activities he constructed a wealth of meanings and was particularly impressed by the difficulties of travel for the explorers and fur traders.

When he thought back over his experiences he described some of the successful strategies he had used in the games. Solving the problems in the games had interested him. He also puzzled over ideas raised by the metaphors and analogies for some of the games.

He commented on how he liked being in the woods, and found learning in the outdoors meaningful. He observed that the environment was used as a backdrop for learning. "We used the wooded park area to help us learn more about how animals live and protect themselves and get food, and how the 'l'hivernant' catch or trap furs so that they can survive" (p. 116).

Mark noticed that students helped each other to cope with the adjustment to a different setting. He thought the social experience of the residency was important because students cooperated to help each other adapt. He observed, "It helps a class to learn how they adapt to the environment around them, so that if they don't adapt too quickly then you sort of have to help them out and show them ways that they can adapt." With his strong interest in the concepts behind environmental issues and his general sense of responsibility "to cooperate," Mark seemed quite likely to take action to "help the environment" in the future.

Jason

Jason seemed so tense and fidgety during our first discussion I wondered if he would choose to be interviewed again. He did seem eager to continue, however, and I noticed that he was noticeably more relaxed the next time we talked, perhaps because he knew I was interested in his ideas. Laurie, his teacher, told me that he had some difficulties getting along with other children, and was rather insecure in the classroom setting. He seemed nervous about the prospect of the stay at the EE Centre, as if he worried that he would not be able to meet the behaviour requirements. He said later, "I nearly didn't get to go because I wasn't very good."

Jason liked playing street hockey, baseball and "every kind of sport you can think of, practically." He preferred doing active physical games to school work. "I don't really like to write," he admitted. He said he was looking forward to the cross-country skiing and to learning more about the environment at the EE Centre.

The residency was both a social and a personal challenge for Jason, which he met with considerable success. The teachers commented on how cooperative and helpful he was at the Centre, and that he participated enthusiastically in activities.

Through his experiences he came to some awkward self-realizations which he was able to discuss, and seemed to have learned from. For example, he had to step down from being leader on the David Thompson Climb (p. 96), and his class-mates teased him when they saw that his cross-country skiing was not as good as

he had announced. He said, "I just went out and tried my best."

Jason expressed many meanings for the historical activities. He enjoyed the fast-paced, experiential activities, and handling concrete things such as the furs and game cards. Perhaps he was the kind of student who, as Kay had described, thrives on the active approaches to learning emphasized at the Centre.

When I asked Jason what link the Initiative Tasks (see Appendix G) had with environment, he said he did not know. He did not appear to think metaphorically. Also, despite winning a prize for completing the Environmental Bingo Game (p. 90), he wondered why the Centre would ask students to pick up litter. He said, "I don't know why we did that." It would seem that he did not feel a personal obligation to act for the environment.

However, when I asked him if there was any link between cooperating with others as at the EE Centre, and learning about environment, he said, "Well, we are all in the environment, that's for sure. For some of the people and most of the animals, there's hardly enough room."

Jesse

Jesse was active in sports, outgoing and confident. He liked the woods and outdoors. His family had a cabin at a lake where he enjoyed the nature experiences. He sometimes just sat and watched nature. "Sometimes I just like being by myself. At my lake I've got this little secret place of mine there."

When I asked Jesse what the environment was, he answered, "The environment is something that can get ruined if it's not treated right, like in forest fires." I asked him what kids should think about the environment so that when they grew up things would be better. He said:

> Well, they might be worried about the environment when they were kids, so they decide to help it in the future, when they are older. Because, they might be, like, worried sick kind of, because some people are real worriers about the environment.

He had noticed that other children were worrying about the environment. He himself was not too worried, although he knew there were serious problems.

He had not been to the EE Centre before. He thought his teacher was taking the class there "to learn more about nature." He himself was looking forward to "just having fun, just being normal, I guess."

At the Centre Jesse especially enjoyed the running games and sports, and learning more about the lives of animals in the woods. He thought the role-playing games helped him learn about the fur trade. "We got to play it and see what it was like, really."

James

James was good natured and easy-going. He had lots of friends in the class. His favourite activities were playing ice or street hockey, watching TV and playing with his dog.

James had not stayed at the EE Centre before, and was expecting "to have

fun" there.

It was entertaining to interview James. He talked volubly about any topic I introduced and often made creative digressions. He seemed to really enjoy being interviewed, and would make comments like, "As I told you in my last interview."

He read fantasy books, and liked horror shows. His imaginative nature was revealed in his descriptions of his experiences at the EE Centre.

James described the environment as "a place outside. It's just landmarks, and things that have happened. It's land, mountains, fields, meadows . . . animals. Humans are environmental." He added, "I like the environment because the environment sometimes can be pretty." He seemed to value the outdoor environment and have an appreciation of natural beauty. He was aware that pollution had damaged and changed the environment. Something his grandmother had told him had made a strong impact on his stance toward pollution. She told him that "the North Saskatchewan River changed over in twenty years. Twenty or forty years ago it was blue as the sky in summer and you could swim in it, but then people started to pollute it." On three separate occasions he mentioned his grandmother's image of a time when the river was unpolluted.

He seemed to be well informed about some of the pollution issues, and told me that he gained this information from the classroom and from television.

When I asked him if he worried about the environment, he said, "I used to worry about it a lot, but not that much any more, as I'm getting older. Because

you have more ways to save it and help it and all that." He seemed to feel optimistic that environmental problems would be solved, although he, himself, did not indicate a strong interest to act.

James' experiences at the EE Centre increased his awareness of action strategies, however. When I asked him how and what children learned by going to the EE Centre, he said, "you get to learn more about the environment where you are trying to help the environment at the same time. At school you are just sitting at a desk writing down sentences about the environment." He had noticed the compost at the EE Centre. He said, "My grandfather tried to have a compost, but it just wouldn't work." Seeing a compost used successfully made him reconsider this possibility for taking environmental action.

Discussion

All the children in the study were aware of urgent environmental concerns. Some were better informed about the issues than others. The children's conceptions of environment were limited. Their focus was on concepts of pollution and possible actions to reduce waste "to help the environment." There are a number of reasons to explain this. Children can see litter and have familiarity with how their family deals with waste. Media and school both emphasize that litter cleanup contributes to resolving environmental problems. Other environmental issues are not as visible to children and have complex scientific explanations.

Children feel efficacy to control litter, for example, whether or not they choose to drop trash or to collect it, but they do not feel they can do much about more removed issues such as acid rain or toxic waste.

Prior knowledge is significant in influencing construction of meaning (Driver, 1989; Osborne & Freyberg, 1985; Osborne & Wittrock, 1985). The portraits of the children's meaning-making reveal several instances where the child's construction of meaning was consistent with his or her prior ideas. The children participated in the same activities but constructed different meanings or realities for them. Becky, for example, interpreted her experiences in the Animal Survival Game (p. 107) with respect to her personal experience of seeing a dead deer in a ravine and her conclusion that the deer had died from drinking the polluted creek water. Daymon used his knowledge of how team-work is necessary to "win" in sports to illustrate an environmental concept. Monique was impressed by the environmentally responsible behaviours of the EE Centre staff, yet at the same time, prompted by discussions following their participation in the game How Many Bears in the Forest (see Appendix E) wondered if they sometimes lapsed in their environmental efforts, as she did. The students' various explanations for the mechanism of how bears metabolize fat derived from their prior knowledge.

Several children made conceptual links between their meanings for historical and environmental activities even though this was not intended by either the teacher or the Centre. Perhaps Kay's stress upon an environmental framework for

the field trip influenced the children's meaning-making. The students seemed to recognize that understanding people's relationship to environment in the past contributes to understanding issues about environment in the present and for the future.

The children revealed a strong sense of concern about environmental problems and issues. There was a recurrent theme of anxiety about the state of the environment and about the future, in the students' meanings. Their conceptions of the future of the environment held images of loss, damage, pollution and death.

The children revealed a variety of emotions which accompanied expression of their environmental concerns. These included touching expressions of sadness, anger, pessimism or hopefulness. These emotions usually appeared to drive the individual's stance or approach towards environmental problems, yet sometimes seemed to contradict them. Janet and John were apprehensive about the future, but both felt that becoming knowledgeable was important and both expressed an optimistic belief that they personally could and would take responsible action toward the solution of environmental problems. Daymon was interested in becoming informed about the environment but his stance was that he personally did not need to take action toward finding environmental solutions. He believed that somebody else would solve the problems. Gigliotti (1990) comments, "People have selectively screened the environmental education messages and constructed belief structures to support their own value systems rather than alter their own lifestyles

to any great degree" (p. 11). Becky, though taking personal action through picking up litter, held a pessimistic belief that there would not be enough done in time to save people from environmental disaster. Monique seemed aggressively interested in environmental concerns and expressed alarm about the future of the environment. At the same time she felt guilty that she sometimes could not hold up to her environmentally responsible resolutions. She found that other interests often distracted her from her efforts. These patterns of response to environmental problems, already apparent in children, are readily identifiable in the adult population of society.

For many students, the social and affective meanings in the field trip seemed to hold greater significance than the cognitive meanings they constructed. Yet, their many experiences resulted in construction of new or expanded meanings for historical and environmental concepts related to the intended curriculum. Undoubtedly the social and emotional meanings contributed to the students' motivation to construct environmental meanings. Iozzi (1989a) affirms that the affective domain is the key entry point to EE. Involving children in the sorts of cooperative role-playing and simulation games such as those at the EE Centre has implications for environmental education.

CHAPTER VI

CHILDREN'S CONSTRUCTION OF MEANING IN THE ENVIRONMENTAL GAMES AND ACTIVITIES

Introduction

In this chapter I describe some of the specific activities the children experienced in the environmental program at the EE Centre and interpret, compare and contrast the responses of individual children to each activity. Although the activities presented concepts in different curricular areas, including social studies, science, environmental issues and outdoor recreation, recurrent themes of cooperation, competition and survival emerged in the children's meaning-making. These themes are explored here, as well as possible influences on the children's construction of meaning.

The activities are presented in the chronological order in which they occurred over the three days. Not all the acitivities experienced by the children are discussed. Other activities experienced by the children at the EE Centre are discussed in Appendices D, E, F, and G. A detailed schedule of activities in the three-day program appears in Appendix C. The schedule shows actual times for activities and debriefing sessions.

The Environmental Bingo Game

> We had a bingo sheet and it had all these things that we had to do, like shut off the light, get a styrofoam cup, and stuff. We didn't get a line, but on the chart, on the big bingo card, we filled it up.
>
> Monique

The Environmental Bingo Game is introduced to visiting students when they first arrive at the EE Centre. The objective of the game is to promote environmental awareness and action through participation in a non-competitive activity. A large bingo chart hung in the central meeting area shows sketches representing a variety of activities that can be done as positive environmental action. Some examples include: using cloth hand-towels in the washrooms to save on paper use, picking up litter, placing items in recycling bins, turning off lights, being thrifty with wash water, and writing a letter of concern to a public agency. If visiting students complete all the tasks during their residency, the name of their school is added to an Environmental Action Honour Role displayed beside the bingo chart.

In addition to the large bingo game, each room group of students is given a small bingo card with fewer tasks to complete. At the end of the residence visit small rewards such as posters are given for completing various parts of the Environmental Bingo.

During the orientation briefing on the first morning at the Centre, an EE Centre staff member explained that at the Centre the staff were trying to practise

environmentally sensitive behaviours, and that the bingo game was an invitation to the students to think about and practise these also. Participation in the bingo game was optional, but certain environmental actions were part of the EE Centre routine and were expected of all visitors as well. These included using cloth table napkins, not wasting food, and recycling paper, tin and glass.

The Debriefing

Prior to departure on the third day of the field trip, an EE Centre teacher engaged the students in a discussion about their efforts in the Environmental Bingo. She reviewed some of the environmentally responsible actions taken by the children while at the Centre, asking such questions as:

What things are environmentally friendly?

What is in a compost? What do we use a compost for?

Where does our garbage end up?

She suggested that the students try the different ways of dealing with waste modelled at the EE Centre, and urged them to try to reduce and recycle. She then gave out small rewards to the several room groups that had completed a single line bingo, and to the one group that had completed all the tasks on their card.

Themes

The students' responses to the Environmental Bingo Game expose the dilemma of how to motivate people to become more environmentally responsible. The students responded variously to the incentive of extrinsic rewards. Most

seemed motivated to complete the tasks to bring recognition to their group, and most appeared to enjoy the challenge of the search. Some children revealed that participation in the game increased their awareness of different ways to be environmentally responsible and many some showed awareness of the necessity for cooperation to work toward environmental solutions. Several examples follow.

Monique seemed to think that taking environmental action was a good thing as long as it was convenient. She wondered how students were expected to carry out the bingo tasks while coping with the demands of all the activities. She explained:

> I know that you should collect garbage and everything, but if you are walking down the street in your cross-country skis or in your snowshoes, you are not going to carry all this garbage while you are doing the activity.

She thought that rewards would motivate children in a game situation but would not influence their participation in environmental action on the long term. She explained, "Prizes sometimes help, but you are not doing it because you want to, you are doing it because you get a prize if you do it." She believed that motivation for taking positive environmental action came from deeper feelings of commitment. She said, "You have to do it on your own or else it's not worth anything."

Jason described the game as "kind of easy and fun." He thought that it was easy to find trash for the bingo in the area of the EE Centre and enjoyed checking off accomplished tasks. He said, "When we played the game there, there was a

whole bunch of trash around . . . and all we had to do was go and pick it up, and then we would get something marked off our chart." Jason was motivated by the prospect of material reward. He admitted, "I was wondering what we would get at the end when we finished everything." His room group was the only group of students who completed all the tasks on the small bingo card. As well as the prize, Jason was pleased to have the recognition. He said, "We won it. Nobody else got the whole chart." Ironically, Jason appeared not to link the game with environmental responsibility. He said, "I was wondering why I had to pick up all the stuff" as if he did not really feel personal responsibility for taking environmental action.

Janet also enjoyed completing the tasks of the environmental bingo game. During the visit she proudly commented:

> There's the chart where you had to hang up those little trees, or whatever you did? I put up the first one. It was really neat, because you had to find a lot of different things, and the only thing that I think that we haven't found is a six pack holder, plastic.

She was motivated by the challenge of the search and the incentive of recognition. She thought such rewards would appeal to students. She commented, "They made recycling lots of fun. You had your name on a chart, and everybody wanted that. So everybody looked through the garbage." Through participation in the game for three days she found that she began to think about what the game meant:

> Just think . . . all the environment is, like, garbage. How you usually don't pick it up, but now you have to, really. And it doesn't take much time to pick up all the garbage. If everybody did it, there

wouldn't be any garbage left.

Participation in the game contributed to her growing awareness that everyone must take responsibility to help solve environmental problems.

In contrast to Jason, Janet thought that the area around the EE Centre did not have much litter and concluded, "It was clean from all the other kids that have been there." Seeing the names of other schools who had participated in Environmental Bingo at the EE Centre made her think about her connection with other children, strangers from other schools, who were also contributing to an environmental effort. She thought that when other students come to the EE Centre, "they might see the same thing, and [become interested in] picking up all the garbage and getting the environmental bingo finished." She seemed to understand the game in a metaphorical sense. Winning the bingo meant completing every task and winning was more likely with everyone's participation. Similarly, "winning" on environmental problems requires everyone's contribution and cooperation. Everyone needs to work on "getting the environmental bingo finished."

James thought that prizes or rewards might be necessary to motivate some people to take more action about pollution. He described the Environmental Bingo as "just some way that you would make kids pick up their garbage because you get a prize." He did, however, think that some people act responsibly even if they do not earn prizes. He cited the example of his father who picked up some litter every time he went to his parking lot at a downtown business. The game reminded

James "how important it is to pick up garbage, and how it harms the environment."

John, on the other hand, found that his group did not put much thought or effort into completing tasks for the bingo cards. He remarked, "Some other groups, on the bingo, they've almost got a full card and we haven't really got around to that. We're not really that worried about it." It is interesting to speculate why his group did not pursue completing the tasks. Perhaps they did not feel participation reflected worthwhile environmental action, or perhaps one of the tasks, such as writing a letter of concern, seemed inconvenient. Other possibilities were that the rewards of the game did not appeal to them or perhaps they were just not inclined to be environmentally responsible.

Despite his group's lack of interest in the bingo game tasks, the residency seemed to increase John's environmental awareness. A few days after the visit he mentioned noticing litter along his paper route, and said he had thought about picking it up:

> I just started a paper route. In a couple more days I'm going to take, like, a garbage bag. If I see any garbage on my route, I'm just going to pick it up. I was thinking about doing that.

Commentary

The children's comments about their participation in the Environmental Bingo Game provide interesting indicators of their personal level of environmental responsibility. Most children responded to the small incentives such as the satisfaction of "collecting" points for tasks completed, the recognition for their

contribution or the small rewards. At the same time, most of the children revealed to me that they did not think that taking environmental action for reward would work in the long term. Jason, for example, would pick up litter for a reward but seemed unlikely to take voluntary environmental action otherwise. Janet, in contrast, enjoyed receiving the various rewards of the game, and also indicated increased awareness and intention to act. John's group did not complete the bingo because "we're not really that worried about it," yet later John said that being at the EE Centre had increased his awareness of environmental problems. The game did seem to achieve the objective of increasing the children's awareness, and focuses attention on the dilemma of how to motivate people to act in more environmentally responsible ways.

The David Thompson Climb

> We were the ones who successfully got up all together, and we were the first ones up. We kept on faliing on this one hill, and everyone else was going up that hill. And we thought, we can't get up that hill, so we went up a different way . . . . And I think we did good, because we all successfully stayed together and I think the main part was just talking and saying, OK we can get up this hill, and we can.
>
> Melanie

In this game students role-played members of David Thompson's exploration expedition trying to reach the top of Athabasca Pass. Each team of seven or eight students was given a rope which they were to hold onto as they

climbed a steep, wooded hill with no set paths. The objective of the activity was to climb the hill as a team without anyone letting go of the rope. Ice and snow on the hill increased the challenge. The activity was not supposed to be a competition but an exercise in learning to cooperate as a group in order to successfully reach an objective.

Introduction to the Historical Context

Before the outdoor activity took place, Marnie, an EE Centre teacher, presented a half-hour historical introduction in a classroom. "Does anybody have any idea why we are studying this?" she began. "Why do we study the fur trade?" She linked early exploration of Western Canada with expansion of the fur trade. She provided details about David Thompson's life, his skill in map-making, and his discovery of a pass through the Rocky Mountains. "What kinds of hazards and hardships would his party have had to put up with?" she asked. She described the loaded canoes and the arduous portages. "What did these explorers do in wintertime? How did they cross the mountains?"

The David Thompson Climb

Marnie then introduced the role-playing activity. She invited the students to imagine what it was like for David Thompson and his party when they crossed the Great Divide by way of Athabasca Pass in 1810-1811. "You are going to go back in time and take the role of one of those men or women. What would you be thinking of if you were on the trip crossing the pass?"

She divided the class into four groups and gave each group a rope. The students chose cards on which were printed names and character sketches of members of Thompson's expedition: Batoche, Bourre, Charlotte Small, etc. These were the roles they would play. "What would it take to get over the pass?" she asked. She stressed that the game was not a race to see which team could get to the top of the hill first and emphasized that members of a team were not supposed to let go of the rope. "Your most important task is to stay with the group." She then led the students to the wooded area where the climb took place. The climb took about half an hour.

The Debriefing

After the David Thompson Climb, Marnie gathered the group together back in the classroom for a short discussion about their experiences of the Climb. She asked, "Tell me, what were the things that it did take to make your group successful?" Some of the students' responses were:

-Take paths that nobody else has taken.

-Teamwork. We could help the other people coming up.

-Cooperation. Talk to each other.

-We followed the rabbit tracks.

-We grabbed onto the trees.

-Everybody was talking so loud we couldn't hear this girl who was screaming for help because her hand was caught in a tree.

Marnie then reminded the students that the objective of the activity was to cooperate as a group to solve a problem. She explained:

> I want to share with you what happens sometime with classes. The leader takes off and just goes. They don't ever look behind and when somebody starts to get behind, they yell, "Come on you guys, keep up." You know, because it's a race. They want to get there first . . . I hope there weren't any in this room.

A student said, "There was."

Themes

The children's first comments were about their personal experiences on the climb, and their feelings associated with these. As we continued talking, three themes emerged in the children's meanings for the David Thompson Climb: competition, cooperation, and survival.

Competition Themes

Although Marnie had established that the purpose of the Climb was to succeed as a group, it seemed important to the students how their group ranked in reaching the top of the hill. This was usually the first comment made. For example, when I asked John about his experience of the Climb he said, "It didn't work out that good. We were one of the last ones to get up."

Daymon too viewed the activity as a race and was pleased that his group was first to complete the task. The competition aspect was important to him and also, his opportunity to experience leadership. He said:

> Well, our team was in last. And what we did is, we changed [leaders] . . . so I switched him places. I started creating routes . . .

> and we finally got ahead of everybody, and we got in first. We were up at the top before anybody.

Cooperation Themes

The curricular goals of the activity were to give the students an opportunity to practise cooperative problem-solving skills and to increase their understanding of the hardships of the early explorers in Western Canada. Students' descriptions of their experiences revealed various meanings for cooperation:

Effective leadership

John believed that successful cooperation in a group was dependent on good leadership. Leadership in this challenge involved more than leading the group in a certain direction. John explained, "Our leader was Jason and well, he didn't really help us, he just wanted to get up. We all sort of helped each other, and then eventually we all got up." John's group discussed their dilemma and accepted a group consensus.

Jason said he learned that strong members in expeditions still can only proceed at the rate of the slowest. I noticed that some members of Jason's group protested to him about his choices during the climb. He reflected to me later in private:

> It was all right until I led them to the big icy spot and then we couldn't get up it. Sometimes you are a little bit better than other people and you've kind of got to help them up, not pull them up the hill. Kind of like that.

Talking, sharing ideas, and giving encouragement

Daymon said that his group observed the progress of other groups, shared ideas before making group decisions, and gave each other encouragement:

> We were encouraging each other to talk and things, and tell people not to go this way and tell them, there's a sharp cliff coming up ahead. We talked it through, like saying look, that team is slipping so don't go that way. That team hit an ice patch and they can't get up, so.

The members of this group seemed to contribute fairly equally to the group's efforts and decisions. Talking helped them to decide on routes.

Melanie also thought that an important aspect of cooperation was to let everybody talk things out. She described her group's strategy:

> We just kind of all cooperated. When someone went this way we all went, and then, we just all started to talk to each other and we got up there. I think the main part was just talking and saying, "OK we can get up this hill," and "We can."

Cooperating with the decisions of the majority

Monique believed that cooperation was necessary if everyone in the group was to complete the climb holding onto the rope. However, her notion of cooperation seemed to be that others should do what she suggested. She said, "Well, I cooperated. I told people where they should go and where I didn't think they should go, and why." There were differing opinions on route finding in her group.

Monique reflected on the necessity for Thompson's followers to have cooperated in order to make the expeditions go smoothly. Her personal experience

of the climb made her reflect on what exploration called for in the past. She understood the necessity for expedition members to cooperate with the leadership. She commented, "David Thompson was the leader and you would have to follow his commands . . . If you didn't like him you wouldn't be very good on the David Thompson climb."

Mark believed his suggestions were good ones but was unable to persuade his group to try them out. He cooperated by going along with the others' ideas even though he felt frustrated:

> Two people in our group that we did the climb with, they didn't listen to me, and we took a lot of chances with the climb. They wanted to go straight up [whereas] I wanted to zigzag and go slower because the deeper snow gives you more support.

Going "straight up" meant pulling individuals one by one up a short ice slope with the rope. Mark patiently went along with the others' ideas, although the group experienced the consequences which he had predicted. He said, "I went along with their plan. . . . They didn't learn very fast. It sort of took them until the very last hill." He showed both a cooperative spirit, and potential leadership qualities when he commented, "I just gave them encouragement, and told them that they can do it."

Survival Themes

Physical survival of the explorers

Both the historical introduction and the group climbing activity helped the

children to construct ideas about what the members of David Thompson's expedition might have experienced as they tried to explore and map the rugged landscape of western Canada. They were impressed by "what it took" to survive the hazards and difficulties of travel across the harsh environment.

Janet's experiences helped her imagine what it might have been like to travel in a blizzard. She said:

> I learned that they had to stay together in a blizzard. But they still had to walk . . . I never knew that they had that bad blizzards that they couldn't see anything and they might walk around in circles.

She focused on the concern of becoming lost, a relevant concern to children. Participating in the climb seems to have reinforced her idea about how important it would have been for expedition members to cooperate to survive dangerous situations. She understood that "staying with the group" in the activity represented a safety strategy for wilderness travel. She also seemed impressed that the explorers would sometimes have to keep moving in bad weather. She recognized that the small discomforts of the present day challenge represented the greater hardships endured by the historical expedition.

Jesse seemed to understand the difficulties faced by the explorers much more clearly after his personal experience. He said the climb helped him to learn:

> How it was if you were David Thompson and the crew. How it was in the winter when there was blizzards. They had blizzards when they did that too so it was harder. Except they were stronger because they were, like, adults, so it might have been a bit easier for them.

He seemed to imagine himself as a boy on the real exploration trip, trying to cope

with it all. He said that the challenge helped him understand that on such expeditions the men had to cooperate and "help each other."

I wondered if the children thought about the people in history whose roles they were supposed to be taking in the climb simulation. Monique said that although the students wore cards with names of people who participated in the real expeditions she was not role-playing. "We weren't pretending. We were just climbing up the hill as ourselves." Other students also remarked that they forgot about their "character." It seemed that the challenge to "survive" was real enough in the present.

At least one student did not seem to find the climb enjoyable. Becky said after the climb, "I just don't understand why they made us climb up a really icy hill like that." She had found the climb challenging even though it was a short hike up a wooded hill about twenty metres in elevation. Perhaps there were problems within her group, or perhaps she found the physical exertion demanding. She did not seem to realize that the real challenge in the activity was learning to work with others cooperatively, nor did she seem to understand the intended analogy to the hardships of the explorers.

Survival of the natural environment

In an interview several weeks after the field trip I asked Monique if there was anything she was still wondering about from her experiences on the field trip. She wondered if there was supposed to be a connection between the David

Thompson Climb and learning about the environment. She puzzled:

> Does he care about the environment? Did he care, I mean? There wasn't really any problems about the environment then, but if he was here today, if he came and visited us from a long time ago, today, what would he tell us? If he got all the kids in the world together and told them about how the world was like before all this pollution and stuff came?

She made a connection between her vision of the natural environment of the explorers, the present environmental situation and a doubtful environmental future. She thought the environment had been damaged and changed since the time of the explorers and thought the future was precarious. She seemed to wonder how the past could inform people's present course of actions and help them work toward a viable future:

> Say he came in here, this world, right now, and he looks at it and he says, like, "What happened to the earth?" Like, it's been so polluted since he was alive that no-one would be able to see him or see what he did then. Everything was, like, nice then, but now the ozone layer is almost destroyed. Soon we are going to be dying from the sunlight.

Commentary

The comments of the students show that many of them considered the climb to be a competition. "Winning" was important to them, despite the teachers' remonstrations. Winning, however, requires cooperation, which the students also recognized. Where time or linear distance is involved in cooperative game activities, it seems difficult to distract children from making winning a tacit goal or a personal sense of reward.

The children expressed several ideas about what they thought was required for "cooperation." They thought leadership was needed to help a group come to a consensus in a fair and acceptable manner. They also said that sharing ideas, communicating clearly, and offering active encouragement would assist cooperative group functioning. Willingness to go along with the majority's decision was perhaps the most critical aspect of cooperation, they decided from their experiences.

Survival themes emerged in the children's construction of meaning about the hardships which had to be endured to survive on the early exploration expeditions. Some children contrasted their image of the natural environment in the present day with that in the explorer's time, reflecting their sense of damage and loss. They expressed concern for the future of the natural environment.

Discussion of such cooperative and competitive interpretations of this activity might reveal to the children something about the difficulty of working toward solutions to environmental problems. The level of success achieved through working as a group is often affected by whether the goals of individuals within the group are similar.

Historical activities such as the David Thompson Climb provide perspectives on people's changing use of and attitudes toward the natural environment.

The Animal Survival Game

> We played the Animal Survival Game. There was a Sasquatch and a Mother nature, hunters and animals. The animals run away from the hunters and the hunters run away from the Sasquatch and Mother Nature and it's sort of like that. It's sort of like the cycle. Mother Nature was sort of like the wind and everything that would stop them from getting their food. . . . The Sasquatch and Mother Nature were the boss. They couldn't be killed by anyone. . . . For the animals to survive they needed three stamps of food and water, and one life [card].
>
> Monique

At the EE Centre this game was called "The Fur Trade Game." However, I found that the children confused this game with the "L'Hivernant" Game, so to prevent confusion, I referred to the game as "The Animal Survival Game" as some of the students were doing.

The Animal Survival Game is a tag-like simulation game played in a wooded area. The objective is to teach concepts about predator-prey relationships and the challenges fur trappers face to obtain furs. In the game, students become trappers or animals. A small number of trappers (ie. predators) chase a much larger number of animals. The trapper's objective is to have a successful season, and the animal's objective is to survive.

The animals start out with four life cards and must give one up when caught. To "survive" the game the animals must retain at least one life card, and have obtained three food and water clips on a card by the end of the game. Teachers walking about the hunting area carry hole-punches and provide these clips

when asked.

Each time an animal is caught by a trapper, the animal forfeits one life card. To have had a successful season the trappers must accumulate at least 20 animal life cards.

There are two other predator characters in the game. Mother Nature represents the influence of other factors affecting the survival of animals in the wild. Mother Nature carries a "bag of tricks" or cards describing handicaps or bonuses to give to animals or trappers she catches. The other character is a general predator, which the EE Centre teacher told the students they could call the Sasquatch or Bigfoot or the Hairy Mammoth.

When introducing the game, the EE Centre teacher briefly discussed animal survival needs, adaptations and food chains. The game took place in a few acres of snow-covered hilly woods. Students from both the visiting schools participated. The actual game took 50 minutes.

The Debriefing

After the game the students gathered indoors again for a short debriefing session in which they discussed their experiences of the game and the strategies they used to "survive." A teacher (from the other school) asked a few questions that summarized the game and elicited the children's game strategies. She asked:

How many animals survived?

How many trappers caught 20 animals?

What were some of the cards given out by Mother Nature?

What might the trappers have done to catch more animals?

She did not, however, ask other questions suggested on a hand-out provided by the EE Centre, such as, "Can you tell how a fur-bearing animal feels?" and "Why would we have you play a game like this?" Through talking with the individual students I revealed some of their ideas about these other meanings for the game.

Survival Themes

Survival as a Game Player

During the game, "survival" as a game player was, of course, predominant in the children's thinking. Each student had a personal story to tell about his or her experiences in the game, the strategies used to hide or escape, and how the required food and water clips had been obtained.

One of the most interesting aspects of the game to the children seemed to be their encounters with the character variously referred to as the Sasquatch, Big Foot or Hairy Mammoth. Since this role was taken by a tall fast-running boy, escape seemed possible only through trickery.

Janet commented, "That was fun, trying to survive." The most memorable moment in the game for her was when she faced the Hairy Mammoth, and tricked him before he could catch her:

> He was right standing in front of me and I said I might give him one of those life cards. And he didn't tag me or anything . . . and before

> I reached into my pocket I just ran down the hill, and took off on him. So that still counts, because he didn't tag me.

Daymon referred to this character as the Sasquatch. When I asked him "What did the game mean to you?" he answered, "Keep out of the way of Sasquatches." The character of the Sasquatch seemed to symbolize the exciting sense of danger and suspense in the game. He said, "The Sasquatch only caught me once. He jumped. That was funny. He jumped, and wow!"

Survival Adaptations of Animals

Students linked their experiences in the game to various ideas about how animals survive in the wild. Several commented on how the game made them think about survival from the animals' point of view.

During the game, for example, Jesse thought about what it must mean for an animal to be on constant alert for hunters or predators:

> They always have to watch out. Looking everywhere, not sure of anything. They are always scared that something is going to jump out. That's why when people or kids try to get close to them, they run away because they are not quite sure if they should trust this thing.

Jane said she found herself thinking like an animal in the game. "When I was hiding," she said, "I was thinking if I was really an animal I would be hiding in a better place than this because I would be a lot smaller and probably would dig a hole or something."

Monique too, entered into the role of an animal, and felt this helped her understand the stress animals live under.

> I wasn't thinking I was a kid, I was thinking I was an animal . . . . You are going to run to try to keep yourself alive. . . I learned that animals have it very hard. We only played that for about an hour but all the time the animals have to be on watch, not just half an hour or an hour.

As an "animal" in the game, Monique found that it was actually more difficult to obtain the food and water clips necessary to survive in the game than it was to stay hidden from the hunters. The animal players had to take risks to come out of hiding to find the teachers walking around with the hole punchers to obtain these clips. Her experience in the game made her consider the risks animals take to obtain food and water in nature:

> They don't have to die from getting caught by a hunter. They can die from not having any food. . . Everybody knew that already, but it sort of stunned me, because I thought they don't have to really look for their food, it's like, there . . . but that's not true. There were teachers walking around with the stamps. It was hard to find them.

The game helped Monique to think about how animals are adapted for survival. She wondered if animals warn each other about approaching predators, because when she was playing the game, she warned other "animals" about the approach of the "trappers":

> Animals can't talk, but every time I saw hunters I'd scream. I'd yell it out and stuff. I don't think animals do this, but I warned everybody else if I saw one. Finally I calmed down.

She thought about the adaptations of animals to escape predators. "They've got to run fast!" she commented. She also thought that the animals' sense of smell was an important adaptation for survival:

> An animal could be walking along and there could be a hunter, and the hunter didn't see the animal so the animal went and hid . . . The animal doesn't even have to be around the hunter to see him or smell him.

The game helped Melanie understand animals' drive to survive. She said that during the game, "my thoughts were going through my head saying, 'I've got to get away. I've got to live.'" She remembered a discussion her class had had during science about animals' adaptations for survival and used this prior knowledge as a strategy. She tried hiding and being silent and learned how camouflage helped animals hide from predators:

> When we were talking about animals in science, we were talking about how they hid, so I went off and hid in a bush, and the Sasquatch went right by me, and didn't even see me, and I was just hiding in a bush. . . . It was like, wow! It really is true.

Survival of the Sasquatch Myth

Most of the children volunteered to be chosen as the character the EE Centre teacher introduced as "the Hairy Mammoth or the Sasquatch or Big Foot, whatever you want to call him." It seemed to hold a powerful status in the game. Raymon told me he had very much wanted to play this role and was disappointed when not chosen. This fitted with his interest in reading fantasy. Also, perhaps because of his small size, playing a powerful figure especially appealed to him. I asked him if the game taught him anything about what the life of a wild animal might be like. He said, "Hunters try to kill you animals, and then Sasquatches, almost like, strangle hunters." I then asked him if Sasquatches really existed. He

answered, "Yeah, there's real Sasquatches." When I did not say anything, but just looked at him, he qualified this statement cautiously, "But I don't think there's much in Canada. There's some in the States." I sensed that Daymon gained some sort of satisfaction from believing that Sasquatches existed. As evidence for their existence he referred vaguely to hearing about them on television.

When Melanie mentioned the Sasquatch character in the Animal Survival Game I also asked her if she thought Sasquatches really existed. She said, "No," then added, "I'm not sure." I then asked her if Sasquatches were not real why the character might appear in the game. She said that the game was "probably saying that he is your predator." She explained that the Sasquatch probably represented animal predators in general. I found it interesting that she understood the symbolic role of the character in the game.

James and Jason did not think Sasquatches existed and accepted the presence of the character in the game without explaining its symbolic role.

Jesse and Mark brought up the question of the Sasquatch several weeks after the residency at the EE Centre when I asked them if there was anything they were still wondering about from the field trip. They referred to the character as the Woolly Mammoth, using the name of the prehistoric animal. Jesse said he wondered where the fur traders got the idea of the existence of the Woolly Mammoth. He asked, "Did they just see him? Or was it some guy who had lots of fur all over him?"

Mark pointed out to Jesse that there were different names for the creature, such as Yeti or Big Foot, and that the Woolly Mammoth might be something else altogether. Mark did wonder himself though, if such a creature existed. He had seen a television program once which suggested that there was evidence for its existence:

> *It says that many people have had encounters with it but it hasn't hurt anybody. And they usually hide. It's been hiding from people for many years now. I'm wondering how it can stay there so long and it hasn't killed anybody yet.*

Jesse agreed with Mark that he too had seen programs offering evidence about the animal's existence. He commented to Mark:

> *I don't think it does exist, but it might. Like, I've seen lots of things about it on TV and they've had pictures of it, and everything. You've seen shows like that, right?*

It is interesting that he sought his friend's corroboration of the television evidence, affirming Bruner's view (1986) that meaning is negotiated socially. Solomon (1987) also discusses how the construction of meaning in science can be influenced by social interactions. She says, "Belief in our own ideas is astonishingly hard to form or maintain without the collaboration of others" (p. 63). In such "'life world knowing' the essential criterion is no longer the internal logic of the explanation, but that it should be recognized and shared by others . . . This continual reaffirmation of social notions makes them very durable and resistant to change" (p. 67).

Commentary

In the Animal Survival Game, role-playing the part of animals helped the children understand in a real sense how animals' adaptations help them to escape from predators. They gained increased awareness of the complex factors at work in predator-prey relationships.

The children's conflicting ideas about the existence of Sasquatches, though briefly alluded to here, also illustrate the importance of television as a source of science and environmental information. Solomon (1990) states that "several studies have shown that both adults and older children attribute a great deal of their science knowledge to television viewing" (p. 110).

Research in the area of children's conceptions in science (Driver, 1981, Osborne & Freyberg, 1985) shows that children often hold ideas about phenomena which differ substantially from the explanations of scientists. These misconceptions or alternative frameworks make sense to the students and are sometimes very difficult to change through classroom experiences. For example, some students were willing to accept the existence of Sasquatches despite the lack of scientific evidence because they seemed to find this conception plausible and satisfying in some way. Posner, Strike, Hewson and Gertzog (1982) propose that conceptual change is more likely to take place when an alternative conception is found to be more intelligible, plausible and fruitful.

The debriefing discussions after such environmental games allow children to

share their various personal meanings, and assist concept building about the natural systems simulated by the game. Driver (1989) stresses the importance of peer group discussion as a support for conceptual change.

The "L'Hivernant" Game and Related Activities

> It was about finding these little animals. They are on plastic cards. You had to be a trapper and there was two teams. There was the Hudson's team and the Northwest . . . Some pelts are worth five points, four points, three points . . . They were behind trees and then on the ground.
>
> Janet

In the "L'Hivernant" Game students role-played the historical competition between the Hudson's Bay and the Northwest fur trading companies to collect furs. The game was played outdoors in some snowy woods. Wearing plastic snowshoes and voyageur-style hooded cloaks and sashes, the students role-played the trappers or fur traders who wintered over at the fur forts (the "hivernants"). Cards carrying pictures of different fur-bearing mammals were hidden in the woods. These represented the animals to be trapped. In the game, which lasted half an hour, the trappers retrieved the animal cards one at a time. Walking on snow-shoes was a new experience for most of the students.

Prior to the game the students gathered indoors for a half-hour introduction to the history of the fur trade, presented by an EE Centre teacher. This included a slide presentation and examination of a genuine beaver pelt and beaver hat.

During the game the students were not aware of the different trade values of the animal cards they collected. Later, inside the EE Centre, the students changed roles, and became natives bartering furs for goods or tokens at a "fur fort." The students traded the animal cards they had personally collected in the outdoor game. Teachers role-played tough-bargaining fur traders who tried to purchase the furs from the natives for the lowest price possible.

At another session, the students were given an opportunity to handle a collection of about twenty cured pelts, including fox, wolf, beaver, marten, lynx, mink and wolverine. Kay and an EE Centre teacher provided information about trapping and hunting, curing pelts, and the factors influencing the values of furs. The students briefly discussed some of the issues about the fur industry, past and present.

Themes

Themes of competition and survival emerged from the children's responses to the "L'Hivernant" Game, the fur trading activity and the examination of the fur pelts. Many of these responses were constructed within a curricular context.

As for the Animal Survival Game, the children commented on the meaning of competition in the actual game, as well as on the game's representative meanings about the historical fur trade competition.

Interrelated with themes of competition were themes of survival. The

children constructed meanings for the physical survival of the "hivernants'", the economic survival of the fur companies, the cultural and physical survival of natives and the survival of fur-bearing mammals.

Competition Themes

Competition in the Game

All the students I interviewed appeared to enjoy the competitive nature of the "L'Hivernant" game. The number and kinds of animal cards each child collected in the game, and whether he or she was on the winning team seemed important. The students participated enthusiastically, although most found it difficult to manoeuvre the snow-shoes over the small hills.

Jason thought wearing the snowshoes to collect the cards made an interesting variation on a competitive search game. He said, "It was really fun, because you had to go around finding all these paper animals on snowshoes, and it's kind of hard to get there before the other team does." He did not, however, seem to connect the game to learning about the history of the fur traders. When I asked him, "What did that game help you to understand about the fur trade history and those two fur trading companies?" he replied, "I don't really think it helped me to learn anything, because I haven't really done very much with it, so." By not "doing much with it" he apparently meant he had not yet studied the fur traders in school.

Becky, too, seemed unsure that the game meant anything more than a fun

competition held in the outdoors. Playing a game to win was a meaning that satisfied her. When I asked, "What was the game about?" she said, "Well, I don't know. You had to collect animals, to collect all the stuff, but Northwest won."

I then probed further, "You are not sure what the game was supposed to teach you?"

Her response was, "No! Not at all."

Both Jason and Becky appeared to recall very little from the slides or historical introduction, as well. Perhaps a lack of prior knowledge about the fur trade hampered them from constructing much historical meaning from the game. Likely students' construction of historical meaning in this game is enhanced if the students have already undertaken some classroom study of the fur trade prior to arrival.

Reasons for the Fur Trade Competition

Eight of the ten students I interviewed, however, understood that the game was meant to represent the competition between the two fur trading companies.

For Janet, the "hivernant" experiences provided a meaningful introduction to the history of the fur trade. She learned "there was a big competition between these people." She added, "I never knew . . . . They're both going after the same thing."

All the students recalled the beaver hat and pelt. Handling these concrete objects seemed to help them understand the reasons for the fur trade competition.

The beaver hat appeared to be a symbol of the fur trade competition.

Monique, for example, explained that the reason for the Canadian fur trade was to get beaver furs to make the hats for people in Europe. She learned that the beaver hat was a luxury item, not a necessity. She explained, "In Europe they all wore beaver hats but only the really rich people could have them."

Touching the hat and pelt also helped make students aware of some of the processes such as curing and shaving that the pelts underwent before being sewn into hats. Two months after the field trip Mark was still puzzling about how the hard beaver hats were constructed from the soft beaver pelts. He said, "Going back to the felt hat, I'm wondering how they processed it, how they cut off all their hair and got to the softer stuff, and how they actually built the hat to make it sort of stiff."

Mark's continuing curiosity weeks after handling the hat demonstrates the importance of using concrete objects to stimulate children's construction of meaning. Osborne and Wittrock (1985) stress the importance of sensory experience in their generative learning model. Manipulating objects allows students to seek answers and pose questions that have relevance to their personal prior knowledge.

Role-playing Indians trading furs at a fort also seemed to be significant in helping students reconstruct their ideas about the fur trade. For example, Melanie, like Janet, explained that before the "L'Hivernant" activities she had not been sure who the fur traders were, or what things were traded. She thought the two

companies might have traded furs with each other. "I thought that they just traded fur for fur, not the fur to, like, metal and guns and pots and pans."

Economic Competition

In the "L'Hivernant" Game the students knew that there was a limited number of animal cards to compete for. This aspect of the simulation game seemed to help Daymon understand that the fur trade companies were competing for a limited resource of fur-bearing animals in an area. He said, "It's hard to find furs because the furs are hard to get. Because one company gets some furs and the other company didn't get as many." He found it difficult to locate the cards hidden in the woods. Such personal experience may help him understand that trapping and hunting the real animals in the woods was not easy.

John learned that economic profit was the reason for the fur trade competition:

> I learned about the competition that they were into . . . . The more furs that they made or got, the more hats they could make, the more coats they could make, and then they could make more money.

During the "L'Hivernant" Game he found that it was difficult to climb the small hills on snowshoes to search for cards. He noticed that members of the other team who made the effort to climb the hills to search for cards in fact located more and won the competition. He said, "My group, we were more staying in the open areas where it was more flat and everything and like, they were taking more risks than we were to get furs." Perhaps this aspect of the simulation game helped him

understand how the fur companies had to take risks and use aggressive strategies to compete in the fur trade business.

Influence of the Fur Trade on Natives

Role-playing natives bartering furs for trade goods at the fort helped the students understand the influence the fur trade competition had upon natives. Trading the cards they had collected in the "L'Hivernant" Game helped them to experience trading from the natives' perspective. Each card represented the pelt of a fur-bearing animal. Some students had collected several cards and some had collected only a few.

Not being aware of the relative trade value of the cards they collected until the bartering activity helped the students understand how the white person's economy would have made the natives re-assess their values for hunting and trapping.

They learned that the pelts of different animals held different value to the fur traders, and that factors such as the condition of the pelt and the season in which it was collected also affected its trade value. Janet commented on how she had been unaware of the representative value of the animal cards she collected during the game until she traded at the indoor "fort":

> I never knew how much they could get. I never knew how much the pelts were worth. Like, a rabbit pelt was less than a bear pelt and everything. We never knew how much the pelts were. That there were good pelts and bad pelts. I never had a beaver, I just got bears.

Most students saw the natives as being disadvantaged in their trading experiences with the fur companies. Jason expressed his view of the fur traders:

> They are trying to make you get less as possible so they get better, so they'd kind of get an advantage of it. They would lower the prices as far as they could for you to trade, and then they would go somewhere else and they would get more money for it, so.

He wondered if the natives figured "they were getting cheated and then the natives started getting meaner, kind of tougher." Having only one card to trade made Jason feel the competition keenly on a personal level, and also made him think about the difficulties of human survival:

> It's kind of hard to bargain . . . I only had one animal, and everybody else got two or three. I learned that beaver furs are worth a lot more than some other furs like muskrat, and I had the muskrat, and I only got one [token]. Sarah had the beaver and she got four or five for it.

Melanie too, found that role-playing an Indian trading furs at the fort helped her to understand the fur trade from the viewpoint of the natives. In the trading activity she found how hard it was to get the trade value she thought her animal card was worth:

> It was difficult because if you say, "This is a really good quality of fur, I'd like three tokens for it," a lot of people [the traders] would say, "It's got shots in it," or whatever. And it's hard to agree with them . . . I remember, I was trading and Mrs. W. [the trader] kept on saying, "No, no, no. It's not that good. You only get one coin." And I kept on saying, "No, no, no. It's no deal."

I asked her whether this helped her understand how the Indians might have felt about such trading experiences. She linked her experiences with the possible frustration of the natives in the past. She speculated, "Maybe the Indians would

just walk away with their pelts."

John understood from the game that often the natives were not allowed to examine the trade goods closely. This seemed unfair to him. He spoke sympathetically about the natives' dilemma:

> I think it would have been kind of hard for them, because they couldn't really go in and see what everything really does look like. They would try to get their highest price but they would kind of be cheated for what they had.

Children have a keen sense of what is fair in games, so experiences like these in the role-playing would have been significant in developing their understanding of the fur traders' treatment of natives.

Monique also gained the impression that natives were exploited. She explained the role of alcohol in the fur trading: "They tried to soften the Indians up. They gave them fire water and stuff to try to soften them up . . . [so] they'd give more furs."

Daymon tried to reason out whether the trading was fair. He understood how difficult it was for natives to hunt or trap animals and wondered about whether, if he were back in the past, he would trade the many furs needed to buy a gun:

> It depends on what kind of furs, like, if there was ten furs for a gun, I wouldn't do that. Because fur, you can keep warm, but a gun, you can only shoot furs. But for five furs I might, because then you could shoot more furs with that. But then, how would you get your bullets?

He pictured himself in the role of a native while thinking out this dilemma, which

is the intention of the game. Daymon also reflected on the consequences of the traders being unfair to natives in their trading:

> [The Indians] had to make decisions to trade or to not trade, because, if one of them [the traders] ripped them off, if someone gave them something that was useless, it would be . . . They would start a war!

His comment reflects a sense of anger and indignation about the fur traders' exploitation of the natives.

Survival Themes

Survival of the "Hivernants"

Experiencing the various "hivernant" activities gave the children an awareness of the hardships endured by the fur traders or "hivernants" who wintered over at the fur company outposts and forts. They learned that survival was not an easy matter. They found out that snowshoeing was not as easy as it had appeared in the slide presentation on the fur trade. Janet summed up many students' experiences of trying to hurry about on the snowshoes: "It was really hard walking around on snowshoes. Everyone was falling down and falling downhill and rolling down everywhere."

Mark learned from the "hivernant" activities that "the fur trade means a lot more than just trading furs. And that the "l'hivernant" had to dress properly for survival, and that a lot of people from France, strong people, became "l'hivernant"."

John learned that the "hivernants" had to adapt to the different climate and conditions. "I thought that was kind of neat that they just quickly adapted to what you needed to wear and stuff, to survive," he said.

Survival of the Natives

Students constructed meanings about how the developing fur trade affected the cultural and physical survival of the natives. Mark expressed a new awareness of the realities and difficulties of survival for the native peoples. He thought about how long it probably took to hunt an animal without a gun:

> It taught me that it takes longer than you think to catch, like one animal . . . We have guns. The Indians had only traps and they would have probably have to wait days before they caught something in them. For us, all we would have to do is shoot the animal and we would have something.

Janet commented on how the fur trading practices might have affected the livelihood of the natives and the survival of their culture. From her classroom studies of Indians prior to coming to the Centre she had learned that the Indians did not waste the animals that they killed. She thus thought that alcohol was not a worthy exchange for the hard-earned furs:

> It's just that they were trading a whole moose for a couple of bottles of liqueur [sic] or something, and the moose gave them the moose hide, the fur, the antlers. And you could make the antlers into something, and the meat. All just for a couple of bottles of liqueur . . . They drank it because they weren't used to it . . . So they gave away that whole moose that they hunted.

Survival of Animals

Janet hinted that she thought the fur trade depleted the populations of fur-bearing animals. "There was a lot more animals then than there is now. You hardly ever see a bear around here. I don't think there is any."

Handling the various fur pelts helped the students to reconstruct their ideas about what fur trading meant in terms of the actual killing of animals. Prior to this experience many of them may have been thinking about the furs in abstract terms. Handling the real animal furs encouraged a variety of responses and helped many of the students to reassess the meaning of the fur trade in terms of their personal values. Their comments and questions revealed some of their present attitudes to hunting and trapping, and reminded them in a concrete way that the fur trade was based on killing wildlife.

Several students remarked on the sensation of touching the different pelts and learned that the texture and nature of animal furs varies considerably. Melanie commented, "It felt really neat just touching them and feeling how they felt. There was a little tiny mouse, and I didn't like that. There was a beaver and it was soft." The "mouse" fur was actually an ermine skin. Handling the furs helped her understand how the prices varied according to the different qualities of fur. However, as she was touching them she began to think about what it meant to harvest animals for their fur. She said, "Some thoughts went through my mind, like, why do they do that? Like, why do they have to kill an animal just for their

fur and then throw out everything else?"

When I asked her why people might kill animals, she acknowledged that they do it "to get money to survive for their food."

John noticed the differing texture of the furs and wondered if this was a survival adaptation for the animal. He noticed that the smaller animals had softer fur, and wondered if that helped them move more quietly through the bushes. He thought larger animals might need tougher fur to withstand the abrasion of bushes and twigs:

> The more bigger the cat, it became a little more rougher and with some smaller animals it was really soft, because they wouldn't be rustling around so much and going through so many bushes and everything.

Touching the pelts made some students think about the killing of animals and exposed their stance toward hunting. John was curious about how the animals had been killed. He noticed that some of the fur pelts were in the form of a tube:

> I was thinking about how they would kill them because some of the furs, they didn't have a scratch on them. On one of the lynx there wasn't any sort of hole in it anywhere. It looked like it was just trapped and then it was put to sleep and then they, like, carved it out because there was a hole.

He referred to the animal being "put to sleep", cautiously skirting the acknowledgement of death. Perhaps he did not want to think about the animal's pain.

Monique's reaction to touching the furs was quite negative. She

commented:

> That was disgusting! I didn't like that one bit! I liked the feel of the furs, but a boy that was sitting beside me would look inside their mouth and roll their eyes. It was gross! I wouldn't mind if the animal was alive and had its full body and was able to move and everything, but it was just sitting there and dead. That it is dead and it used to be alive, and somebody killed it, and I'm holding something dead!

I asked her, "What are your thoughts about killing wild animals then?" She said, "No. That's all I have to say, is no, no, no!" Monique seemed to have been surprised by her own reaction. Perhaps she had been thinking of the furs in an intellectual way. She found the realization of death and the deliberate killing of animals upsetting to think about.

Commentary

The children's construction of meaning seemed to be influenced significantly by the prior ideas they brought to their experiences of the "Hivernant" activities. "Winning" and trading for profit were important meanings. The children's personal experiences in the games appeared to influence their construction of historical meanings. Their own difficulties snowshoeing, for example, helped them comprehend hardships experienced by the "hivernants." Their awareness that economic competition involves tough business strategies and risk taking was increased through their own experiences bartering. They felt personally the sense of frustration that natives would have experienced in the tough

and exploitive fur trading practises. Competition for reward or to "survive" or succeed in situations are pervasive themes in the children's meaning-making, and hold importance for them.

The students are likely to remember their personal experiences and the meanings they constructed for these activities focusing on the historical fur trade. These will influence the interpretation and meanings they construct for future learning experiences about the fur trade history.

Themes of competition and survival are recurrent in the children's construction of meaning for the "Hivernant" activities. Most students understood that the fur trade companies were competing with each other for economic survival and that this required adventuring into unknown country and establishing trade relations with native hunters and trappers.

The game appeared to influence their construction of environmental meaning related to the fur trade history as well. Several expressed understanding of the devastating consequences of intense hunting pressure on the populations of fur-bearing mammals.

CHAPTER VII

DISCUSSION

Introduction

In this study I have been interested in exploring three questions:

What meanings do children construct for their experiences in an environmental education program?

What appears to influence this construction of meaning?

What are the implications for environmental education?

In Chapter IV, I described the educational contexts in which the ten profile children constructed environmental meaning: the teacher's classroom and program, and the Environmental Education Centre. In Chapter V, I presented portraits of each child's personal world of meaning for environment. I explored each child's environmental beliefs, knowledge, attitudes and intentions to take action. In Chapter VI, I described some of the activities at the EE Centre, and provided samples of the children's responses for each, revealing emerging themes.

In this chapter I summarize the themes of competition, cooperation and survival which emerged from the children's construction of meaning about environment, theorize about possible influences upon the children's construction of meaning, and discuss implications for environmental education.

Emerging Themes: Survival, Competition and Cooperation

The major themes in the children's meaning-making for their experiences at the EE Centre centred around survival, competition and cooperation. The children's experience of their own survival, competition or cooperation in the activities and games helped them to understand the significance of these themes in the lives of the animals or people they role-played. These themes also underlie current environmental issues and problems.

Survival themes entered into the children's meaning-making on several levels. Winning or "surviving" in the games was important, perhaps because it provided social status and the satisfaction of using successful strategies in the games. For the historical activities, the children expressed meanings for what it was like to survive as an explorer, fur trader, or native Indian.

Survival was a recurrent theme in the children's environmental meanings. The survival theme emerged in their meanings for ecological concepts; for example, the survival of bears competing for the available food supply, and survival of animals from predators. They revealed both cognitive and affective meanings concerning their own survival and the survival of other living things in an endangered environment. The strong messages about global pollution and over-population presented in some of the game debriefings were reflected in some students' meanings about environmental issues. I gained an appreciation that I was talking to a generation of children who are growing up in an atmosphere of deep

pessimism about their future, and that in various ways, they are striving to cope with this.

Competition was also a recurrent theme in the children's meaning-making, on various levels. Foremost was the importance of competing to win in some of the games. Most of the children enjoyed competition and participated keenly whatever the activity; perhaps, as for survival, because competition establishes status in a group. I found that many of the children constructed competitive meanings for activities even when these were not intended, as for the skiing experience and the David Thompson Climb. They expressed meanings for the competition between living things to survive in nature and for the economic competition between fur trading companies.

Several meanings for cooperation were expressed by the children. They understood the teachers' common meaning for cooperation. In this sense, cooperation meant behaviours such as following rules, having polite manners, and participating willingly in activities. Such meanings appeared to be influenced by the emphasis on behaviour expectations established by both the classroom teacher and the EE Centre staff.

Cooperation also meant contributing to group problem solving in various ways. This kind of meaning emerged during debriefing sessions. Some students also expressed understanding of the figurative meanings offered by the cooperative games; for example, that cooperation among individuals is necessary to solve

environmental problems which affect the group.

These three themes of survival, competition and cooperation have enormous environmental significance. Living things compete for food, water and space. People compete for profit, space and life itself. Survival of life systems on the planet is threatened. The messages in the EE Centre games propose that competition for survival must now become cooperation for survival. Thus the themes seen by the children in the seemingly humble EE Centre activities have larger dimensions. The metaphors can be used as a springboard to model environmental problem-solving strategies, and to offer hopeful solutions. Students found out "what it took" to successfully get their group to the top of a hill or to cross the "toxic wasteland" in the cooperative games. For some students the group strategies and solutions became metaphors for solution of increasingly more complex problems.

Metaphors suggest endlessly unfolding conceptual schemes (Duit, 1991; Sutton, 1992). This multiplicity of "possible worlds" (Goodman, 1978) helps children make the creative leap from the straightforward to the complex, from the present game to envisioning environmental solutions. The metaphors suggested by such environmental games thus contribute to children's empowerment through proposing kernel action strategies.

Influences on Children's Construction of Meaning About the Environment

The children's construction of environmental meaning appeared to be influenced by several factors significant from a constructivist view of learning. These included the influence of the children's prior knowledge; the influence of the various contexts within which the children constructed meaning; the opportunities they had for the social negotiation of meaning both in the debriefing sessions and through sharing experiences continuously for three days; and the engaging and motivating character of the games and activities. The influence of each of these factors on the children's meaning-making will be described.

Prior Knowledge

Constructivist theory purports that the learner's prior knowledge is, perhaps, the most important influence on construction of meaning (Driver, 1989; Osborne & Wittrock, 1985). "People tend to generate perceptions and meanings that are consistent with their prior learning" (Osborne & Wittrock, 1985, p. 64). The portraits of the children's environmental meaning-making reveal that many of the children's interpretations of the activities were consistent with the kinds of ideas they had expressed prior to the visit.

The learner's prior ideas also influence what he or she will attend to or learn in a situation (Osborne & Wittrock, 1985). During the month preceding the field trip, Kay involved the children in classroom studies relevant to the concepts presented on the field trip. She thus attempted to establish a curriculum context for

the children's learning at the EE Centre. Several students did make connections between the concepts discussed in the classroom and those ideas which they constructed at the EE Centre. Likewise, they made connections to their learning at the EE Centre when they returned to class.

The Social Context

Meaning is socially constructed through transactions with others (Bruner, 1986; Solomon, 1987). The context of the EE Centre with its outdoor learning settings, emphasis on environmental awareness and action, and the extended opportunities for social interaction, all contributed to the children's construction of environmental meaning. The games, activities and discussions provided interpretive social settings in which the children could discuss and negotiate meanings. Bruner (1986) describes this social negotiation of meaning:

> Learning in most settings is a communal activity, a sharing of the culture. It is not just that the child must make his knowledge his own, but he must make it his own in a community of those who share his sense of belonging to a culture. It is this that leads me to emphasize not only discovery and invention but the importance of negotiating and sharing. (p. 127)

Children make sense of ideas for themselves but this does not happen in isolation. Several activities provided small group cooperative problem solving situations. Wheatley (1991) comments, "Where children work in small groups they are stimulated by challenges to their ideas and thus recognize the need to reorganize and reconceptualize" (p. 18). Driver (1989) also emphasizes the importance of such peer group discussion to support conceptual change.

Post-Activity Debriefing

At the EE Centre, the children's interest and enthusiasm was captured by the role-playing and simulation games. Within the structure of the games, they had a certain degree of freedom to pursue ideas of interest to themselves, as their many responses indicate. The problem-solving aspects of the games especially provided such opportunities. Allowing ample time for briefing before games and debriefing after the games helped promote children's construction of meaning and to reinforce the intended curricular and social meanings. Such discussions encourage children to reflect metacognitively on their recent experiences and ideas, and to connect these with other learning.

The consultant at the EE Centre expressed awareness of the value of the debriefing sessions when he reminded teachers at the planning inservice to provide adequate time for this in their schedules. During the three days at the EE Centre several different teachers conducted debriefing sessions with the students. Some debriefing sessions were carried out in great depth, perhaps because of time pressures, while others were more hastily conducted.

The importance of debriefing sessions to promote children's construction of meaning became most evident to me when I discovered through my own "debriefing" discussions with the children, what a wealth of different ideas and meanings each individual constructed for the events he or she experienced. Within the framework of each child's own prior ideas, his or her meaning for environment

had relevance and made good sense. It is important for teachers to value and respect children's meanings and to provide time for children to reflect on their experiences and to share their ideas with others. The interview discussions also encouraged reflection. Melanie said, "I feel like it helped me think back . . . You kind of realize the things that you did do. Instead of keeping them all in, you can express them."

Experiential Learning

Osborne and Wittrock (1985) emphasize that sensory-rich experiences make an important contribution to the construction of meaning through providing multiple opportunities for the learner to establish connections with his or her prior knowledge. The children valued the experiential learning opportunities at the EE Centre such as the outdoor setting, the active sports and games, problem-solving with concrete materials, and participation in the numerous environmentally friendly actions. Many of the concepts the students constructed from the games seemed to derive from their physical activity in the situation or from the manipulation of concrete objects.

Personal Stance Toward Acting for the Environment

The children revealed a range of understanding of the ecological concepts and environmental issues presented in the activities at the EE Centre. For example, some expressed more sophisticated understanding than others of predator-prey relationships or the carrying capacity of a habitat. Some expressed detailed

awareness of the complexity of pollution issues, whereas others spoke simplistically about the problems of waste. The depth of understanding for environmental issues and concepts did not, however, seem to be related necessarily to the strength of the child's intention to act for the environment. Intention to act seemed to be a personal matter, not strongly influenced by school experiences.

A few students indicated that having an acquaintance who modelled positive environmental action had influenced their intention to act. This observation is supported by Keeth (1989) who found that the environmental activists she studied all mentioned that having a mentor was a significant influence on their motivation to act environmentally. This suggests that individuals who are significant to the student in an affective or intellectual way can powerfully influence the student's motivation to act for the environment. Hopefully, some teachers fulfill this role.

What emerges from this study is that school experiences and discussions do influence or contribute to the students' construction of meaning about environment, and also to their awareness and concern for environmental issues. Through participation in the activities at the EE Centre, the children constructed a large variety of meanings, many within the intended curricular context. Some of the profile students acknowledged that the visit to the EE Centre had increased their motivation to act for the environment.

Certainly, a single visit to the EE Centre is not likely to be enough to sustain the children's meanings and increased motivation to act for the

environment. It would, however, make a significant contribution within an ongoing program of environmental experiences and education.

Implications for Environmental Education

Using Students' Ideas

How can students' prior knowledge be used to promote environmental learning? To promote construction of meaning in science, Harlen and Osborne (1985) stress the importance of eliciting children's ideas by "encouraging them to ask questions, by encouraging them to explain their reasoning and by helping them to reflect upon their ideas in relation to evidence and the ideas of others" (p. 139). They suggest that the children then be able to pursue questions or work on problems "which they have generated or have accepted as their own" (p. 140). Constructivist learning theory supports such an inquiry approach.

Hungerford and Volk (1990) propose that small group case study of a single environmental issue creates a sense of ownership which may then be a precursor to environmental action behaviour. The elements of choice and freedom to pursue his or her own ideas appear to be important in fostering construction of meaning relevant to the individual child.

Promoting the Social Negotiation of Meaning

Meaning is socially negotiated, in different contexts. The findings of this study suggest that small group cooperative learning situations such as the

environmental games promote discussion and the social negotiation of environmental meaning. In particular, the briefing and debriefing sessions before and after environmental activities contribute significantly to the social negotiation of meaning.

An introductory briefing before an environmental education activity serves to expose students' prior knowledge, elicit questions which drive their interest, and set expectations for learning.

Similarly, debriefing sessions after outdoor environmental activities or field trips are important to encourage the students to reflect on their experiences, and help them to construct shared meanings for the experiences. Such discussions can help effect conceptual change as students undertake the constructivist processes of recognizing, evaluating and revising personal ideas (Baird et al, 1991). Adequate time should be provided for metacognitive discussion of this nature. To best promote construction of meaning in such debriefing sessions, Wheatley (1991) suggests that the teacher should be nonjudgmental, and encourage a variety of ideas and problem-solving solutions without imposing his or her view on the students. The students should be allowed time to discuss and negotiate their ideas. As well, they should be encouraged to express their questions, and say what they are still wondering about (Harlen & Osborne, 1985).

Validating Children's Stances Toward Environmental Issues

Solomon (1987, 1990) acknowledges the tremendous impact of television

upon people's awareness and knowledge of science and environmental issues. The children in the study referred to television as a source of both information about the environment and messages that aroused their anxiety about environmental issues. They used emotionally charged language to describe their impressions of environmental problems, yet most claimed not to worry at length about these. This might suggest that many children have developed coping strategies to counter the possible anxiety they feel about the current depressing environmental outlook.

Solomon (1987) stresses that it is important to provide time and an encouraging climate to allow students to discuss social and environmental issues. Such discussions allow students to appreciate the different stakes and values in the complex issues. It is important that students be able to express their own stance toward environmental issues, and to hear others' stances as well.

Solomon (personal communication, Oct. 23, 1991) also recommended that children be encouraged to express their feelings about current environmental issues. Sharing information, posing solutions and revealing personal stances toward the environmental issues can help ease some of the anxiety they feel about the future of the environment, a concern revealed by children in this study.

Using the Outdoors

Since the majority of schools are located in urban locations, many children have had little exposure to a natural habitat. The Alberta Education policy statement on program continuity (1990) states that an objective of education in

Alberta is "to help children understand that responsible management of the natural environment is one of the greatest challenges and moral demands of our time" (p. 14). The importance of using the natural world as a source of learning is emphasized: "Children can best learn the ethic of caring for all living things by spending time in the backyard, the schoolyard, in natural areas and in the wilderness" (p. 14). Despite this official stance acknowledging the importance of learning EE in the outdoors, few teachers extensively use the natural environment as a source of learning even when opportunities are present near schools.

In this study games and activities took place in an outdoor environment which contributed generously to the students' construction of theoretical environmental concepts. The actual outdoor environment, however, was not studied. Study of the actual environment (eg. through ecology studies, nature observation, environmental impact, effects of pollution) is valued as the most important means of learning about both ecology concepts and environmental issues, yet remains a minor focus of current elementary schooling (Hungerford & Volk, 1990). As Monique, one of the profile students commented, "The best way of learning about nature is to go out where nature is, and then learn about it out there."

Keeth (1989) found that teachers were aware of the important contribution outdoor field trip experiences made to students' construction of meaning about environment, but they did not organize this kind of experience often due to time

restrictions and the difficulties posed by the organization of schools.

Approaches to Environmental Education

Robottom (1987) contends that it is difficult to teach environmental education within the institutionalized setting of schools:

> Environmental education is not easy work . . . . At the school level, environmental education poses significant curriculum and teaching problems for practitioners: it aspires to be interdisciplinary, but the conventional school curriculum is strongly disciplinary; it entails outdoor education but school rules and regulations impose constraints on out-of-classroom activities; it is a form of inquiry teaching, but structures and relationships in schools tend to reproduce more didactic forms of instruction; it is interested in inquiries that are critical, involving critiques of environmental situations, but schooling tends to be more interested in vocational or liberal education. (p. 85)

The environmental education experiences in this study conform to Robottom's descriptors. In the classroom the teacher presented environmental studies as a science subject although the children themselves constructed meaning across contexts. The EE Centre environmental activities were not of an inquiry or critical nature. The programs there promote "entry level" behaviour variables associated with responsible environmental behaviour (Hungerford and Volk, 1990) but do not significantly promote ownership or empowerment behaviour variables.

An interdisciplinary approach to environmental education is supported by research (Hungerford & Volk, 1990; Robottom, 1987; Stevenson, 1987). Alberta Education (1990) supports such integration to promote the continuity of learning. Integration helps the learner make connections between ideas and experiences in various contexts. "One way to foster integration is to organize the curriculum

around key ideas drawn from various school subjects and from personal experience" (p. 6). For outdoor field trips or special excursions such as to the EE Centre, the implication for the teacher is to establish a meaningful curricular context around the event, and to embed environmental education across many contexts and disciplines.

Promoting connections across contexts of time and place can help students imagine a viable future for the environment. It was the children's own efforts to seek environmental meanings in the historical activities that helped me understand both the potential and importance of including an historical dimension in environmental education. The children saw links between the historical activities and the environmental ones. Their comments and ideas suggest that looking back and examining people's beliefs about the environment in the past helped them to construct a deeper understanding about environmental issues in the present and for the future. Examining history provides yet another context for the study of environmental issues.

As discussed earlier, education "in", "about", and "for" the environment are different curricular approaches to environmental education (Neal & Palmer, 1990; Robottom, 1987). Teachers may use the outdoors primarily as a motivating setting for learning "in" or "through" the environment, as in the present study, or they may promote the learning of fundamental concepts "about" the actual environment, or teach knowledge and skills about how to take action "for" the environment.

With the current serious environmental problems, to educate "for" the environment is of urgent concern. Education "in" and "about" the environment do not necessarily lead to action "for" the environment although they contribute to the learner's appreciation, awareness and knowledge of environment. Acting "for" the environment necessitates in-depth knowledge of the environment and skills for identifying and solving environmental problems. Stevenson (1987) argues that EE must be socially critical in nature. Students should develop and defend their own environmental beliefs through "a process of inquiry, critique and reflection" (p. 72). However, he adds, they need to be competent to implement or act on their choice. "Without the ability to act on their choice, they in effect have no choice" (p. 73). For example, in-depth knowledge of ecological concepts is vital. Thus all three approaches are needed to help reach EE objectives.

Education "for" the environment is concerned with environmental decision making and problem solving. Because this "dictates environmentally and socially critical environmental education" it is usually neutralized in schools (Robottom, 1987, p. 95). Teachers are constrained by conservative institutional structures and practices.

Robottom (1987) criticizes the present approach to change in environmental education as technocratic in nature. Teachers act as "technicians who must accept on faith the goals and embedded values of outside goal-setters" (p. 98). He encourages practitioners "to theorize about and research their own activities to

improve the rationality of their own practice" of environmental education (p. 98).

For both the teacher and the EE Centre staff in this study, the socialization of students held priority over environmental education goals. Schools presently emphasize socialization goals at the expense of cognitive learning in science (Stake & Easely, 1979). Socialization (eg. teaching good work habits, attentiveness, and following instructions) is often a priority in science education at the expense of teaching intellectual functions such as critical thinking and good judgement (Olson & Russell, 1984). This subordination of educational goals to social control and the constraints of school organization makes it difficult for teachers to engage students in processes of inquiry into and action on real environmental issues (Stevenson, 1987). The implication is that for environmental education to achieve its urgent goals, teaching for basic environmental literacy must receive a greater thrust in the schools. Gigliotti (1990) proposes:

> People must first believe that solutions to environmental problems are necessary. They must also fully understand the consequences to the environment and to themselves of not taking action to correct these problems. To get this message across, environmental education must become a focal point of the entire educational system from elementary through higher education. (p. 12)

Future Studies

I would like to mention two ideas evolving from this study which have interesting potential for further research. The first is to explore further why the children spoke of environmental problems in such pessimistic language yet claimed

not to really worry about them. Were they really indifferent to the alarming environmental future, or were they so upset or helpless about it that denial becomes a coping strategy?

Another interesting area to explore is the potential of using metaphor and analogy in environmental education activities to suggest empowering strategies to encourage students to act for the environment. This likely would entail study of literature and myth as well as examining the potential of games, simulation models and other teaching heuristics which incorporate metaphor.

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Appendix A

Parent Permission Letter

December, 1991

Dear Parents,

I am a graduate student in the Department of Elementary Education at the University of Alberta. For my master's thesis I am researching children's experience of a residence program at the _____ Environmental Education Centre. I will be exploring the contribution of this program to the students' understanding or attitudes about environment.

Mrs. _____ has kindly agreed to let me conduct my research with her class. I will thus accompany the children from both Mrs. _____'s class and Mrs. _____'s class to the Environmental Education Centre in January. As well, I will be present during some lessons in Mrs. _____'s classroom during January and February to become acquainted with the students and to explore their ideas.

I am seeking your permission to xerox some student work and to audiotape conversations which include your child. I would like to record some class discussions, and also some conversations between myself and individuals. These would focus on the meaning of the field trip to the students, and on their understanding of the environment. Anonymity is assured should your child's comments appear in the future write-up. Would you please indicate your willingness for your child's participation in the study by signing the permission statement at the bottom of the page.

I am hoping this study will contribute to our understanding of what and how children learn through their experiences at the Environmental Education Centre. I appreciate your child's contribution.

Yours sincerely,

(Mrs.) Stella Stirling

Ph.

(Parent Permission Letter, continued)

I give permission to Mrs. Stirling to audiotape conversations including my child _____ and to xerox some of my child's work for the purpose of her Master of Education thesis research.

Parent/Guardian signature: _____

Date: _____

Appendix B

Reference to Research Project in Parent Newsletter

December 9, 1991

Parkland Elementary School

Our students will also be contributing to a university master's research project which is focusing on the impact of the _____ Environmental Education Centre on students' attitudes towards the environment. Ms. Stella Stirling, master's student and previously a classroom teacher, will be observing and interviewing students before, during and after their Environmental Education Centre experience as part of this project. More detailed information will be sent home this week, along with a permission request for your child's involvement in this project. Please return the signed form prior to the given date on the form.

Please contact us if you have any further questions or concerns about the fieldtrip or research project. Your cooperation and assistance in planning for our Environmental Education Centre trip is greatly appreciated.

Sincerely,

Mrs. [Grant]

Mrs. [West]

Appendix C

E E Centre Three-Day Residence Program

Schedule of Activities and Times

DAY 1 JANUARY 29, 1992

9:30 a.m.	Arrival, Room sign-in and Orientation Environmental Bingo Intro. (15 min)
10:15 a.m.	Community Walk
11:00 a.m.	Hosts prepare for lunch
11:15 a.m.	LUNCH
12:15 p.m.	David Thompson Climb: Introduction (35 min.); Game (30 min.); Debriefing (15 min.)
2:00 p.m.	SNACK
2:30 p.m.	Animal Survival Game (Fur Trade Game): Introduction (15 min.); Game (50 min.); Debriefing (10 min.)
4:30 p.m.	Quiet time: Journals, Reading, Games
4:45 p.m.	Hosts prepare for supper
5:00 p.m.	SUPPER
6:00 p.m.	Evening Orientation; Firedrill procedures
6:15 p.m.	Outdoor skating (1 1/2 hr.)
7:50 p.m.	Examining model of city (20 min.) Game (20 min.)
8:30 p.m.	Night residence procedures
8:45 p.m.	SNACK

Schedule of Activities and Times, Continued

9:00 p.m. Sharing circle: highlights, challenges of the day

9:15 p.m. Prepare for bed

10:00 p.m. Lights out

DAY 2 JANUARY 30, 1992

7:15 a.m. Wake-up call

7:45 a.m. Hosts prepare for breakfast

8:00 a.m. BREAKFAST

9:10 a.m. L'Hivernant Game: Fur collecting: Introduction (30 min.); snowshoeing skills 15 min.); game (30 min.)

11:00 a.m. Hosts prepare for lunch

11:15 a.m. LUNCH

12:00 a.m. Cross-country skiing: ski and boot fitting, waxing (indoors, 50 min.); skills (outdoors, 60 min.)

2:00 p.m. SNACK

2:30 p.m. Cross-country skiing: Riverside trail tour (1 hr. 40 min.)

4:30 p.m. Quiet time

4:45 p.m. Hosts prepare for supper

5:00 p.m. SUPPER
Announcements

6:15 p.m. Night Hike/Solo Walk in riverside park

8:00 p.m. L'Hivernant Game: Trading furs at the fort (20 min.); Examination of animal pelts (20 min.)

Schedule of Activities and Times, Continued

8:45 p.m. SNACK

9:00 p.m. Sharing circle: highlights, challenges of the day; Journals

9:15 p.m. Announcements, prepare for bed

9:30 p.m. Quiet time in rooms

10:00 p.m. Lights out

DAY 3 JANUARY 31, 1992

7:15 a.m. Wake-up call

7:45 a.m. Hosts prepare for breakfast

8:00 a.m. BREAKFAST

8:30 a.m. Clean-up and pack; Leave gear in rooms

9:15 a.m. Environmental Game: Win As Much As You Can Indoor game (35 min.); Debriefing (20 min.)

10:15 a.m. Environmental Game: How Many Bears in the Forest? Outdoor game (20 min.); Debriefing (10 min.)

11:00 a.m. Recognition awards Hosts prepare for lunch

11:15 a.m. LUNCH

12:10 p.m. Environmental Bingo: Debriefing and Awards (15 min.) Room clear-out procedures

1:00 p.m. Environmental Games: Initiative Tasks: Crossing the Toxic Waste Site, Crossing the Toxic Lake Games (50 min.); Debriefing (15 min.)

2:10 p.m. Closure for residence stay

2:20 p.m. Bus

Appendix D

Cross-Country Skiing

> I learned how. I'd never been on cross-country skiing before. It was a lot different. A big change for me because I'm used to not taking my heels out of the skis and I almost fell over when I first got on them, because I thought your heels were planted in.
>
> Janet

The cross-country skiing skills were taught by an EE Centre teacher. Instruction began indoors where the children were fitted for boots and skis and given time to scrape and re-wax their skis. The EE teacher demonstrated cross-country ski techniques outside on the snow-covered yard. The children practised these skills on a simple circular obstacle course in the yard and on a nearby slope.

They then carried skis a few blocks to a river-side ski trail where they were divided into three groups according to their skiing ability. Then, with adult leaders, the students went for a 45 minute ski tour along the wooded trail by the river.

Themes

Six of the ten children I interviewed, John, Mark, Jason, Janet, Becky and Monique, all said that the cross-country skiing experience had been the highlight of the stay at the EE Centre for them. The physical exercise, the outdoor aspect, and the skill-building were all acknowledged as reasons for enjoying this activity. John explained, for example, "I just like cross-country skiing a lot and think it's good exercise." I also learned other reasons why cross-country skiing was "the

highlight" and important in their meaning-making.

Mark thought that the time spent involved in the skiing activities contributed to the importance it held for students. He appreciated that time is an important factor which influences meaning-making. When I asked what the highlight of the stay for him was, he said, "I'd say the cross-country skiing, because it was sort of like the biggest thing we ever did for the longest period of time, and we did it more than any other activity."

Some students seemed to view the activity from a competitive perspective. John found that his skill level was comparatively good and said, "I think it was kind of fun being in the lead."

Becky, too, compared her skiing abilities to others'. Although she spoke of the skiing as a highlight, her actual experience seemed to have been a bit discouraging:

> It was my first time cross-country skiing. I've never been on skis before. I've never even been on water skis. The hardest part was getting up one of those stupid hills. I couldn't catch up with anyone.

Jason commented, "I thought I was really good at cross-country skiing, except it turns out that it is almost totally different." He acknowledged, however, that being with other students in the ski situation contributed to his learning. "Sometimes they will encourage you and sometimes they will teach you what to do in a situation that you can't really do anything, like it's too hard for you."

Janet also seemed aware of the importance of group modelling upon

learning. She said, "I learned how to follow a lot of other people. I learned how to do it. I just watched what they were doing and copied exactly."

For some children, enjoyment of the natural environment was an important feature of the ski tour. They appreciated the scenery and small animals that they encountered. Monique described her response to the outdoor setting:

> When we went cross-country skiing we went in this forest part and we saw a whole bunch of trees and squirrels and it smelled so nice. . . . We actually stopped, for about ten minutes, and we just sat there and watched.

Commentary

Again, a competition theme played a subtle undercurrent in the children's construction of meaning. Children are sensitive about their comparative performances in learning events and this competitive element entered into their meanings for the skiing. Their experiences skiing and snowshoeing also helped them understand, through actual experience, the contribution of such skills to exploration and the historical fur trade. Some students acknowledged that learning from each other was helpful.

As well, the outdoor sport experiences contributed to fostering environmental sensitivity and appreciation, one of the "critical" environmental education components for changing learner behaviour toward the environment noted by Hungerford and Volk (1990, p. 14).

Appendix E

How Many Bears Live in the Forest?

> The food was hard to get, because you had to get certain numbers and things, and you had to survive getting all those certain numbers, and water and all that, so I think, a bear's life is pretty hard, considering what our life is like.
>
> Jason

This game is adapted from the Project Wild Elementary Activity Guide (1985, pp. 115-117). In this simulation game students represent black bears competing for the available food supply in a habitat. The game helps demonstrate the concept of carrying capacity. Carrying capacity is the maximum population size of animals that a given habitat or environment can support on a year-round basis, or during the most critical season. Habitat factors which influence this include the supply of food, water, shelter and space available to a wildlife species (Canadian Wildlife Federation, 1985).

The game was played outdoors at the EE Centre. An area of the yard represented the "forest." Each "bear" chose a place at one end of the yard to be their "den." Cards representing different kinds and weights of food in a bear's diet were scattered at random over the yard. At a signal, the bears gathered the cards one at a time, and placed them in their dens. Bears could take cards held by other bears but could not steal cards from the den locations. One student was a "blind" bear and wore a blindfold. One was "lame" and had his legs tied together.

Another student represented a female bear who had to collect double the number of cards to provide for her cubs.

The students were not told beforehand that letters and numbers on the cards coded different kinds of foods in the bear's diet, and weight values in kilograms. The "bears" were given about fifteen minutes to gather food from the "forest."

The Debriefing

Marnie, an EE Centre teacher, held a post-game debriefing session in an outdoor teepee. She helped the students determine if they had collected enough food cards to have "survived" in the habitat. To survive, they had to have cards with minimum weights of each kind of food needed. She did this in a series of elimination steps. "To have survived you needed ten kilograms of berries." The suspense of waiting to see if they had the necessary kinds and weight value of food cards heightened the children's interest in the concept of carrying capacity. She then explained the concept of the carrying capacity of a forest for a bear population and asked, "How would it be in nature to be blind or crippled?"

She reviewed the kinds of foods bears eat, and discussed how each type contributes needed nutrients to the bear's diet. She pointed out that the omnivorous diet of bears helps them survive seasonal changes in the supply of particular foodstuffs. When the berry crop is poor, for example, the bears can turn to other foods to survive. She asked the students what happens when bears do not get enough food and mentioned that bears use their fat to survive when they can not

find food, and to live through the winter. She concluded by discussing the concept of the carrying capacity of the planet for the human life on it.

Survival Themes

Competition of Bears for Food

The children were impressed by how few of them had collected the required amounts and variety of food cards to survive as bears in the game setting. John, for example, commented:

> I think that taught us about, like, after a summer, if a bear doesn't get enough food, it is going to die, and only the ones that can find enough food, are probably going to survive. Because out of, I think, forty some bears, only two lived. Because they found enough food.

Melanie thought that her experience of not "surviving" in the game helped her understand how the natural food supply affects animal survival:

> The animals have got to be sort of careful. Like, they've got to get water and they've got to get meat, and they have to get stuff to survive. I think there was only two people who survived and I wasn't one of them.

The inclusion of handicapped bears in the game was to help demonstrate how disadvantaged unfit animals are when competing with fit animals for food. Black bears do become injured, for example, during fights for a mate or over food, or when a large bear tries to kill a young bear and it escapes. Although these injuries may not be immediately life-threatening, they may affect the bears' ability to get food so that they do not lay down enough fat to survive the next winter.

Jesse doubted that bears could survive such handicaps at all, and reflected

on the possible fate of such animals:

> It's harder for them to hunt or get food. There was a blind bear and he wouldn't be able to see his food, but he could smell it and hear it. Or the water, he might hear the stream and he might go down and lick it.

He seemed to personalize the dilemma by trying to imagine how the bears might use other faculties to survive, as if he did not want to contemplate a bear's death by starvation.

Mark also doubted that such disabled bears would survive for long:

> Why did they put a blind bear and a handicapped bear in the forest when we all knew that they wouldn't survive? The handicapped bear, it wouldn't have survived because it wasn't fast enough, and the blind bear couldn't see.

What is the 'Carrying Capacity' of Bears in a Forest?

The game and debriefing discussion helped most students construct some of the intended meanings about carrying capacity. Most could explain the concept in their own words, even though they could not recall the scientific term.

Mark was one of the few students who volunteered the term "carrying capacity" when he later discussed the game with me. He connected his understanding of the concept in the game to recent news he had heard about an area of Alberta where large numbers of wolves were competing for the available food supply:

> It takes lots of food, the carrying capacity. You have to have a carrying capacity for everything, because there was too many bears, like the wolves near Fort McMurray. They were going into the city and attacking the dogs. Well, bears could just go into the city in the

> garbage cans for food because the carrying capacity is too high and the bears would have to go somewhere else. The bears in the forest would have to go into the city.

He used the term incorrectly here, since animals will starve when the carrying capacity of their habitat is too low rather than too high. Carrying capacity refers to the population of animals supported by the habitat. However, he understood the relationship between number of animals and food supply. He further described carrying capacity to mean:

> How much the forest can take, can hold of bears. Because if there was too much bears the forest couldn't provide enough food for them, so a lot of them would starve or they would have to go somewhere else.

Jesse's prior knowledge of bears was that bears usually are solitary hunters. How many bears could live in a forest? From playing the game, Jesse reckoned:

> Well, not many. Because then they would have to move into a different forest. Like if they split up and scattered across there would be enough food, but if they all just stay in one place, then there won't be enough. And there wouldn't be much room in the forest for the bear to roam around. Because the bear likes to just have his own place.

He knew that bears are usually solitary hunters, and questioned the idea suggested by the structure of the game, that bears feed as a crowd. Like most of the children in the study, he thought that bears can find "a different forest" if they can not find enough to eat. In nature, however, alternate territories are usually already occupied by other animals.

What do Bears Eat? What do Bears Need to Survive?

The use of coded cards to represent different foods in the bear's diet seemed to help students remember details about the diet of forest bears. Jesse thought that the actual letters on the food cards helped him recall the foods bears eat. He mused, "Like, "M" was for meat, "N" was for nuts, "B: was for berries, and there was one more. "P" was for, I forget, now. "W" was for water."

Mark learned that bears must eat a variety of foods to obtain the correct nutrition needed to survive:

> It takes more than just one thing that bears need to eat to survive, and you can't eat only one thing. It needs one thing for a while, but after a while, it's sort of needs to have some more stuff, and you have to sort of get enough food for you to survive but if you didn't have one thing, it would starve.

Miscues in Simulation Games

Analogy and metaphor have heuristic value to help teach abstract concepts in science (Duit, 1991; Pope & Gilbert, 1983; Sutton, 1992). Sometimes such comparisons inadvertantly introduce misconceptions. In simulation games students may pick up unintended cues where inaccurate information is inadvertantly provided, or where variables in the game represent the natural situation only in a very general way. Some students playing the Bear/Forest game constructed misconceptions about bear ecology apparently from misinterpreting certain cues provided by the game. Other students thoughtfully evaluated these alternative interpretations using their prior knowledge about bears before accepting or rejecting

them. Some examples of erroneous ideas suggested by cues in the game are that bears hunt in packs, that females leave cubs in the den when they feed and that bears hoard food in their dens.

In the game, a large number of students ("bears") hunt for food cards. Jason included this idea in his construction of how bears hunt. How many bears would there be in a forest? Jason mused, "There could be lots of bears in the forest. Because I never knew, like I didn't think they would be in a pack, like they would all go out there at one time."

In nature bears eat food where they find it. In the game, the "bears" carry the food cards back to their dens. John questioned this concept suggested by the game because his prior knowledge was that bears did not hoard food. He explained, "One day they hunt. Whatever they catch they eat. And then the next day they go out and hunt if they find something. They catch it and eat it. Then the next day the change keeps on going on."

The other children did not bring this up as something they wondered about.

A female bear in the wild takes her cubs with her when she is feeding, because she has to teach them what to eat and how to find it. Thus, the game might introduce the misconception that females leave their young in the den and carry food back to them, as wolves do. Some children might accept this since they may have encountered no other authority than this game to present this concept with respect to bears. Mark indicated that he might be contemplating this notion

when he commented, "And the mom bear probably would have had to run lots, because her cubs would be sort of hungry all the time."

Thus, when erroneous information is represented in simulation games misconceptions may be inadvertently introduced. Even so, as students broaden their encounters with science phenomena, they begin to analyze analogies more critically. The value of simulation games, then, is less to help students construct the scientifically correct explanations, than to stimulate their thinking about the whole process. Such student ideas can be revealed and evaluated in post-game discussion.

How do Bears Use Their Stored Fat? Children's Conceptions

In the debriefing, the EE teacher explained that bears live on their fat when they can not find food. I asked the children in the study what happened to bears when they could not find sufficient food. All of them suggested that the bears would seek food in other areas and some suggested that the bears would survive on stored fat. Their explanations for these phenomena showed interesting variations. Becky, for example, explained:

> Sometimes during the year, the animals can't find enough food. And, so what they do is they start going out of the forest and then they look through the prairies, and they go into town to look through the garbage.

Our discussion at this point went as follows:

Stella: And what do they do if they can not find food?
Becky: They die. Or feed off their fat.
Stella: What does that mean?

Becky: If they have nothing to eat and they can't find anything, they have food already stored in their bodies, so, they cough it up. They cough it up and eat it over again like cows do.
Stella: Oh. Is that what you think the bears do, then?
Becky: Yes. The same thing as cows.
Stella: They cough up some of their fat?
Becky: Yes, from off the food that's already stored. They cough it up sometimes.

Becky appeared to use the conception she had about cows chewing the cud to construct an explanation about how bears metabolize their fat. Our conversation made me wonder what other students understood about how bears used their stored fat.

When I asked Jason, "What happens to bears when they go for quite a while without eating?" he connected the process with digestion. He seemed to have heard about stomach acid and pictured the fat in the skin being digested by acid:

> Well bears, if they don't get any food for a while, they are really big and fat, usually. And the fat that is inside of their skin . . . They can . . . I don't know what you would call it, but, they would kind of . . . That acid inside of them? That stomach acid kind of thing? It would kind of eat that up instead. And they've got so much fat there that it wouldn't bother them for a long time.

When I asked Jesse, "What happens to bears who do not get enough food?" he answered, "They die. They move to another forest. They get sick." I then asked, "Can the bears go for quite a while without eating?" Jesse said, "Yes. They eat off their own fat in their body." He explained further, drawing on his personal experience of losing weight:

> I had that problem once too when . . . my body used to eat off my fat. It's kind of like that when you are not getting enough food, your body starts eating off your own body. It's like some kind of digestive system in your body that takes, eats, kind of like takes fat out of your body.

I asked James "What happens when bears can't find food?" He said, "They die. Or, they would move to a different forest." James thought about the possibility of being lost in the forest himself and starving. He remembered reading a novel in which the characters discuss eating worms, and he tried to picture how the bear would use their fat:

> Bears can eat themselves. You know, if I was lost in the forest, right? Lost in the forest, you could eat leaves, right? And sometimes the leaves are poisonous. If you are starving enough you could dig for worms. Right? In Fried Worms, that's OK, fried worms to eat. (But they taste terrible.) And humans if . . . you are starving, if you had a knife you could put a cut in yourself. You could live on your own blood for a matter of a week.

As for bears:

> Well, they would simply cut themselves and eat their own meat, and they could grow it back. They could eat themselves . . . Eat it, like, you know how they would eat it? When they swallow it, right? It would go right back into their system. Like when humans . . . if you were starving, you would drink your blood, and your blood would go back in your system, back in your body. Because that's what I do when I have a cut, I suck my blood and it goes right back into my system.

Becky and James's explanations apparently were satisfactory to them even if they are misconceptions in terms of the scientifically accepted explanations (Driver, 1989). Becky was thinking about bear survival in an abstract way and was satisfied that bears use their fat to survive, whatever the mechanism. James used

some of his personal ideas about eating to survive in the bush. He told me that he enjoyed watching horror shows such as Arachnophobia and seemed unflustered by a gory explanation for how bears consume their fat supply.

Commentary

Most children constructed meanings close to those intended in the game for such concepts as carrying capacity, the nutritional needs of bears, and the survival of fittest bears. The children constructed many other meanings, some less accurate scientifically. Research in the area of children's conceptions in science shows that "some of the ideas used by children about the natural world are firmly held and often persist despite science teaching" (Driver & Oldham, 1986, p. 106). These are often referred to as alternative conceptions or misconceptions. There was a variety of conceptions about how bears metabolize their fat, about bears' food-getting habits and about their means of survival. The children's explanations reflected that they drew on their personal experiences and prior knowledge to construct ideas that made sense to them. Some of the misconceptions seemed to originate from cues provided in the simulation game.

The children expressed concern for their own survival in the game and for the survival of bears in the woods. Some tried to imagine strategies that might save bears when the food source is low. They did not seem comfortable with accepting that wild animals starve even if it is a natural process.

Appendix F

Win as Much as You Can

The objective of this game is to help students understand the competitive nature of our society and the influence of companies' profit-making motives on environmental concerns. The game suggests through analogy that companies' profit motives influence the production of goods which may contribute to environmental damage or pollution. Students make "agreements" (representing environmental responsibility), just as companies sometimes make agreements to reduce profits in order to produce more environmentally friendly goods. In the game, however, the students know they can secretly renege on their agreement with other groups and gamble against probability to win more "money." Through so doing, they learn that it is better to go for a small secure win than to play against odds for a larger win. The analogy is that if everyone reduces a little, everyone wins environmentally.

The game involves a series of rounds of "voting" to try to win "money." Students are divided into three groups, and each group is given an equal amount of money. For each round the group members decide secretly amongst themselves whether their group will vote X or Y in each round. Then the three groups simultaneously reveal their votes. Outcomes are displayed on a poster. Winning or losing money in each round depends on the outcome of the three votes as follows:

If all three groups vote X, they all win $10 each.

If all three groups vote Y, they all lose $10 each.

However, if the three votes are XYY, then the X vote loses $20 and the Y votes win $10.

If the three votes are XXY, the X votes lose $10 and the Y vote wins $20.

Prior to each round of voting, a "representative" from each of the three companies meets outside the classroom where they discuss and agree upon how their company will vote. (They always agree to have their company vote X.) Upon returning to their group to discuss the vote however, the "representatives" find that sometimes their group over-rules them, and insists on voting Y not X in hopes of winning the higher stakes. Sometimes the company representatives themselves urge the group to vote Y even though they have just agreed to voting X at the "board meeting."

Through probability, over several rounds of voting, the three groups win a larger total sum if they all consistently vote XXX as they agreed.

The students played the game indoors on their last morning at the centre, for about 45 minutes. The three groups rarely all voted X in a round. At the end of 15 rounds, all three groups had significantly less money than they would have if they had consistently voted X as they had agreed upon in each "board meeting."

As an observer, it was interesting to note the willingness of some individuals to go against probability to vote Y. Other students staunchly argued

each time that the vote should remain as X because "we agreed outside." Few seemed to realize that statistical probability was operating against them, even as the rounds continued and the wins and losses were tabulated on a board.

The Debriefing

The EE teacher linked this game of chance to the competition between companies to undersell each other. She described how producing more environmentally friendly products can reduce company profits unless, like in the game, all the companies agree to make the same changes. "We deal with competition in life. We are geared to competition in life." She said that lots of decisions which affect environment are made because of money and asked, "Who loses out?" A student answered, "We do." She then asked why more people do not take more environmental action. Mark suggested that this was because they needed jobs. She asked, "What is wrong with everyone being successful and all making the same amount of money?" The response was, "Nothing."

Themes

Competition to "win" was the important meaning to the students. They seemed to view it as a fun game of chance. While they were playing the game several students tried to guess what the other groups would vote and base their vote on that prediction. The game exposed individuals' variability regarding honouring agreements and what each would risk to "win."

After the EE teacher's debriefing some students seemed to understand the

message that lower profits for all result in everyone "winning" environmentally. For example, Janet learned from the game "that money isn't everything." She also reasoned that her group was "not very trusting" because they only voted X four times in the fifteen rounds. Through playing the game she thought she could understand why some companies choose not to make environmentally friendly products. "There are some companies think they are going to make more money if they don't."

John related his experience of the game to the competition for profits in business:

> I think that we should just sort of stay with X and like, all companies should agree on something, like what somebody said about changing the aerosol cans to spritz bottles.

Mark also interpreted the game to be about "financial business." His concern was for human needs. If the companies did not agree to all make more environmentally friendly products, then the company that did do so might go bankrupt and that would result in employment problems. He said, "If nobody was buying their products they'd have to go bankrupt and then lots of people would be out of jobs and then they wouldn't be making more products."

Commentary

Many students appreciated the environmental analogy presented by this game: if people all agree to reduce and live more environmentally responsible lifestyles, they will all benefit from a healthier environment. However, even after

the EE teacher pointed out that if everybody voted X during the game the group as a whole would benefit, several individuals continued to pressure their group to gamble for higher stakes by voting Y. Perhaps their experiences in the game helped some students realize how human greed influences environmental responsibility.

Appendix G

The Initiative Tasks

The Initiative Tasks are problems which challenge a group to communicate and work together to come up with solutions using given materials in creative ways. The problems are designed so that their physical solution requires participation by most of the group members. The tasks are set in imaginary situations, usually environmental in nature.

The students played two Initiative Tasks in the yard outdoors just prior to departure from the EE Centre.

Task #1: Crossing the Toxic Waste Dump

> We would call out, one, two, and each foot had a number. Each time the leader called out the number, we would move our feet. Then we would all just start saying it and get into the rhythm, and then we would all fall or something. Like, it was pretty hard to get to the other side.
>
> John

In this game each group of four or five students lined up one behind another with their feet attached by rubber straps to two parallel "snowboards" about 1.5 m long. Working together, the group attempted to walk their two boards forward about 10 metres, turn around and return.

To add an environmental dimension, the students were invited to imagine that they were crossing a dangerous toxic waste landfill site to obtain food supplies.

Task #2: Crossing the Toxic Lake

> At the end of the day we had to do all the cooperative games and stuff? I liked that. That one where you had to get across with that board and the tire and the little piece of wood? Monique

Three car tires were set in a row about 2 m apart. Students in groups of five or six were given a narrow plank about 2.2 m long. The task was to have the whole group cross the spaces between the tires and return without touching the ground.

The students were told to imagine that the space represented an acid lake or toxic lake which had to be crossed in order to get to food supplies.

The Debriefing

After the games, Kay explored some of the children's ideas and strategies for solving the tasks. She asked such questions as:

What helped your group?

What ideas did you have?

How did you decide who went first?

Did you use your equipment well?

What contribution did you make?

Themes

These tasks required communication and agreement amongst the students in order to coordinate the group's actions to solve the physical problems. The

students expressed satisfaction about working together to find solutions. They commented on what cooperation entailed for their group. Some also indicated that there was a competitive meaning to these games for them, that "being first" to cross the "toxic waste" was important.

When I asked the profile children what they thought they learned from doing the Initiative Tasks or what they thought the tasks were supposed to teach, I found that their responses centred around two themes: their understanding of cooperation or teamwork, and their interpretations of the environmental themes in the tasks.

To explore the environmental themes I asked the children what the imaginary settings for the games meant to them. I also explored whether the students grasped the analogy between the cooperative approach needed to solve problems in the games and a cooperative approach needed to solve environmental problems.

Cooperation Themes

Mark linked the Initiative Tasks to learning teamwork. He described how his group worked together to move the snowboards:

> It does take more than one person to cross a place to get through. So you have to use teamwork, and you have to know what they were going to do next. . . . We didn't know which foot to pick up first . . . We were the first ones to go there and back twice, but we had to sort of forget about the things that happened and just keep on going and not to worry about what is going to happen next.

He suggested that teamwork involved subordinating personal ambitions to concerns

for the success of the group. He had expressed this concern previously when discussing his ideas for the David Thompson Challenge. Teamwork meant coordinating physical action. Figuring out "what to do next" was the responsibility of the whole group.

Jason observed that clear communication within the group was necessary to successfully solve a task:

> You had to work together, certainly, and you have to tell everybody else what to start with, like your left, right. And it's kind of a partner game. . . . This way you have to cooperate together.

Janet thought the tasks were "fun" and recognized that they could not be solved by individuals. She noted, "You needed teamwork and everything. Because one person couldn't do it all, you needed about five people to help." What was teamwork? Her meaning included the notion that individuals had a responsibility to contribute to the effort. She explained, "When you are next in line you don't just stand there and wait for people behind you to get the board. When you ski, you all had to lift your leg up."

James was the only person I talked to who did not particularly enjoy the Initiative Tasks. He said, "I didn't really like that. It's hard to lift them all at the same time and all that, because I was the only boy in my group." His objection had more to do with his status in the group, perhaps, than with the nature of the task.

I asked Daymon if he learned anything about working with other people

from solving the tasks. He drew upon his experience with team sports to make an comparison:

> You've got to work together to be successful. Because if you are a hockey player and you started skating, and you tried to go get a goal yourself, you're not going to make it. There are five hockey players coming at you at once and then the goalie.

Monique thought that the purpose of doing the Initiative Tasks was to demonstrate that "you have to have team work. If everybody is doing their own thing you are never going to get across. . . . Everybody's got to take their turn and help out, and cheer everybody on, and stuff." When analyzing how the group worked things out, Monique at first considered that "there was one person that was sort of the main leader." Then as she reconstructed how the team had negotiated the crossing, she changed her opinion to "well, nobody was actually the main leader . . . . everybody was a leader."

Monique thought that good leaders inspire others with their ideas and help the group to focus quickly on solutions of the task at hand. "They quickly take charge." Leaders take initiative. As well, she perceived that a successful leader negotiates or wins over the commitment of each individual in the group through including "a little part of his idea" in the plan. It is interesting that she noticed that the students "were all leaders" in the Initiative Tasks, and that each individual's contribution was needed to complete the tasks successfully.

Environmental Themes

Mark thought the scenario of crossing a toxic landfill setting, as in one of

the tasks was a possibility. He explained:

> Well. People don't want to live by land fill sites because if they do, probably their source of food would be on the other side and they would sort of have to cross it, and most people don't want to do that because of the toxic fumes that the garbage releases.

Mark linked the imaginary setting of the game to his ideas about people's objections to living near landfill sites.

> Did playing the games teach James about the environment in any way?
>
> The toxic one, yes. Because some places are like that, full of toxic waste, and people have to cross them. Like, in some true stories. Some true movies? Have toxic waste. There's places in the world that have toxic places in the river, and some toxics like bleach can eat your skin, gas can eat your skin. That's why factories, if you go into gas factories, or toxic factories, you would see them wearing special boots and special uniforms so they don't hurt themselves.

The game made him think about the disposal of toxic chemicals. He thought the imaginary toxic lake setting in the game was plausible and related it to film documentaries he had seen. He was concerned about pollution from such chemicals and "how hard it is for fish to swim in lakes like that."

When I asked Daymon if he thought the world could really become like the imaginary settings in the tasks, he said, "Yes, if they keep on polluting." His use of the pronoun "they" suggested that he disassociated himself from implication in the polluting. Did he seriously think such a future would come about? He said, "Not really, because, well, [the mayor] is trying to recycle and that's helping, but the present government keeps on saying, no, no, yes, yes, no, no." He intimated that he believed the solution of environmental problems was in the hands of figures

more powerful than himself. He seemed to have confidence that somehow the government would muddle through.

Jason focused on his personal experience in the tasks and did not relate the imaginary setting or the methods used to complete the tasks with environmental problems. When I asked him how the game was connected to learning about environment, he said, "I don't think they connect very much. I don't have anything in my head that they connected."

Several weeks after the field trip, however, I asked Jesse and Mark if they were still wondering about anything to do with the field trip. They still puzzled over whether the reference to an acid lake in one of the tasks was meant as an exaggeration, or whether the possibility really existed. Jesse said, "Well, that acid lake. Why would the lake be pure acid? It wouldn't be pure acid!"

Mark agreed. He said, "I was wondering why they thought of an acid lake, not a polluted lake, because it is sort of hard to imagine acid. You really don't find pure acid in very many things."

Jesse tried to rationalize this. He reflected: "Toxic. It could be kind of toxic. Like, if you went in and there was oil and gas in there, your skin would sting after a while." Then, he related this to his personal experience. He added, "Hinton has a lot of pulp. When we drove through to Jasper we could smell the pulp."

The interesting thing here is that the imaginative aspects seemed to stimulate

the children's curiosity and trigger future interest in the topic.

Commentary

Debriefing after such cooperative games is an important metacognitive strategy which helps children analyze their group strategies, their own meanings for cooperation and their environmental interpretations.

Discussions about the students' environmental ideas or interpretations which evolved from such games would also help to further students' environmental awareness. In the debriefing sessions teachers can introduce and discuss the possible messages or metaphors in the tasks, for example, that people must use teamwork and cooperation "to figure out how to get across" current environmental problems. As Monique said, "If everyone is doing their own thing you'll never get across."

The word "initiative" itself comprises two meanings currently of relevance to environmental education. The Houghton Mifflin Canadian Dictionary of the English Language (1980, p. 676) defines "initiative" as both "the first step or action" and also "the power or ability to follow through with a task or plan." Both meanings suggest important considerations for taking environmental action. Taking the first step or action on an issue is important, and so is following through with a plan. Some children are quite capable at making such metaphorical links between initiative games and environmental solutions.